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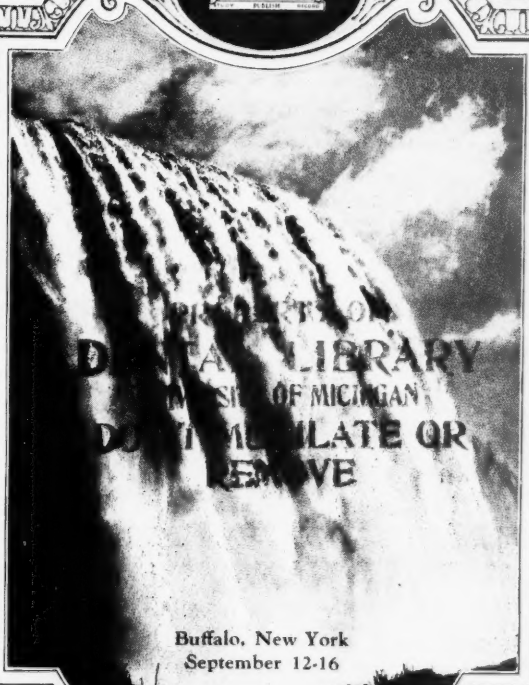
AUGUST

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION



Buffalo, New York
September 12-16

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Original Communications

HISTOGENESIS OF THE ENAMEL*

By SAMUEL W. CHASE, Ph.D., Cleveland, Ohio

THEORIES of amelogenesis are almost as numerous as the number of investigators who have tried to explain the process. Considering the fact that at least twenty-seven theories sufficiently different to justify their separation have been formulated, and the fact that only the cells of the enamel organ and the dental papilla can, by any stretch of the imagination, be thought of as playing any part in the formation of the enamel, it must at once become apparent that most of the combinations and permutations of possibilities have at some time been considered.

This is literally the case. The theories, to be sure, grade almost imperceptibly one into the other, and the same or similar conceptions have been advanced as parts of their theories by the exponents of several hypotheses. Yet all the theories of which I am cognizant can be classified into four groups. These are:

1. Amelogenesis is accomplished by conversion of the ameloblastic layer, or its parts.
2. Amelogenesis is accomplished in part by conversion; in part by secretion.
3. Amelogenesis is entirely a process of secretion: (*a*) without the presence of a membrane; or (*b*) through or within a membrane.
4. The enamel is wholly or in part formed by the odontoblasts.

Before proceeding to the description of my own findings, I shall review briefly representative theories from each of the four groups.

ENAMEL FORMED BY CONVERSION

Schwann (1839), according to Waldeyer (1871), believed that the ameloblasts grow at their basal (dental papillary) ends, the newly formed parts becoming directly transformed into enamel.

*From the Laboratory of Histology and Embryology, Western Reserve University.

*Read before the Section on Research and Biologic Sciences at the Midwinter Clinic of the Chicago Dental Society, Jan. 19, 1932.

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Waldeyer (1871) likewise described the direct calcification of the basal ends of the ameloblasts, but maintained that growth takes place at the distal (nucleated) ends.

Marcusen (1853), cited by Walkhoff (1924), concluded that the entire ameloblast is directly converted into part of an enamel prism; a view which requires the formation of a succession of ameloblasts to produce the enamel.

Morgenstern (1891) later returned to this otherwise abandoned hypothesis.

John Tomes (1848) first described the basal ameloblastic processes later called by his name, and also the resemblance of the interprismatic substance to the shape of a honeycomb. His theory, subscribed to by Charles Tomes also (1897), was to the effect that the enamel prism is formed by chemical and calcareous changes occurring within and around the ameloblastic process, the latter remaining within the prism, which calcifies from periphery to center. Calcification eventually involves Tomes' processes in the prisms of all mammals except marsupials, in which group he believed that the prisms remain tubular.

Bödecker (1894) believed in Heitz-

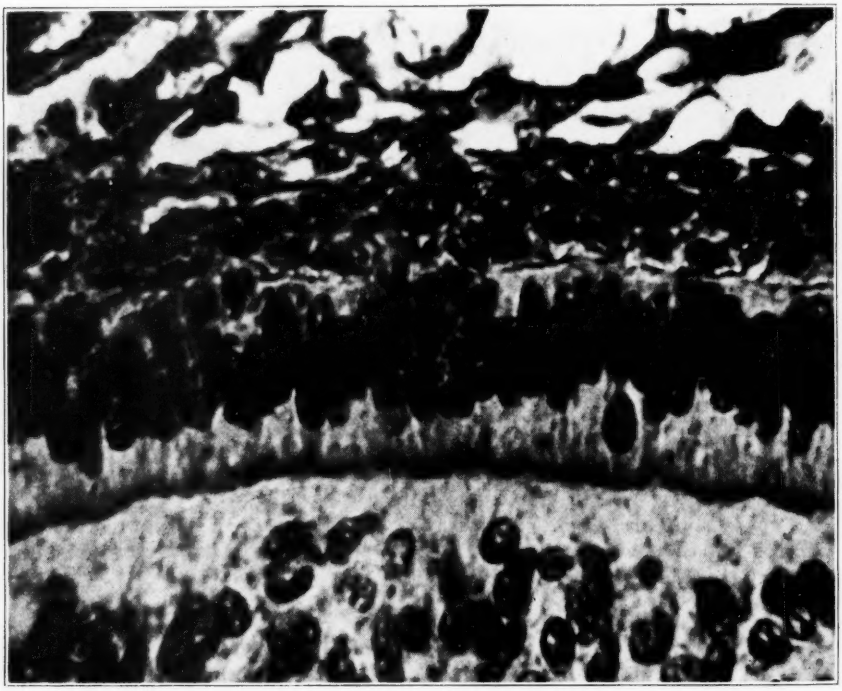

Fig. 1.—Ameloblastic layer before dentinogenesis has begun; showing basal ectoplasmic zone; terminal bars on distal ends of ameloblasts; paucity of enamel-globules. (105 mm. dog; Carnoy's fluid; nitric acid; hematoxylin and eosin; × 1,000.)

mann's conception that cells of the enamel pulp and inner enamel epithelium undergo metaplastic transformation into "medullary corpuscles" which later become calcified to form the enamel.

Fischer (1910) described three zones in the enamel prism: axial, middle and peripheral, corresponding, respectively, to the nucleus, cytoplasm and cell membrane of the ameloblast.

Orbán (1925) believed that the ameloblastic process calcifies to form the prism and that the interprismatic substance arises by prolongation of the basal terminal bars of the ameloblasts. Meyer (1925) held a similar view.

Walkhoff (1927), largely on the evidence of photomicrographs taken by ultraviolet light, was convinced that the ameloblastic processes and the "honeycomb" of surrounding material are both present from the beginning of amelogenesis. Both are fibrillar in structure, and together they form the primordial enamel (*Urschmelz*). The honeycomb arises as originally separate cups, which

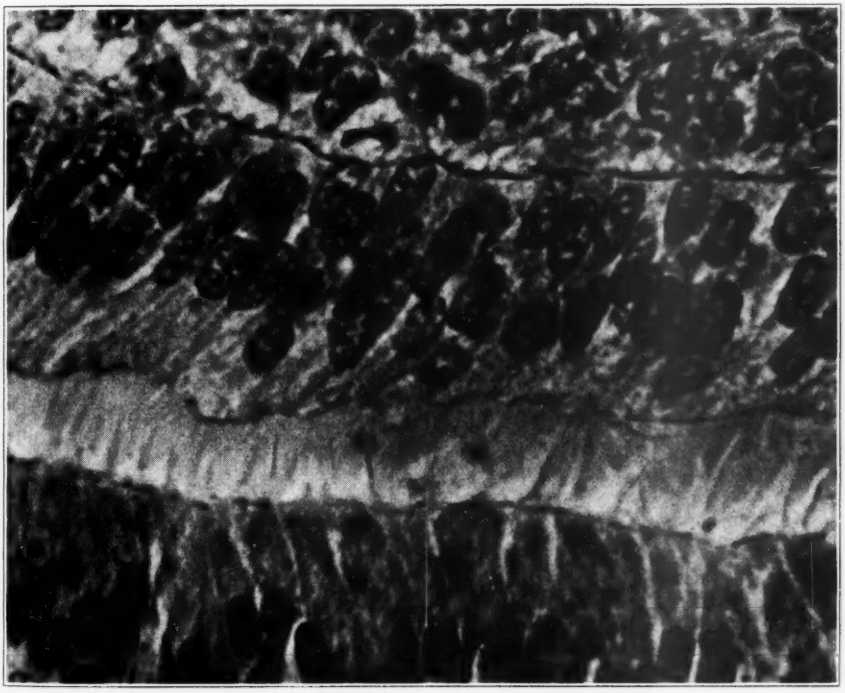

Fig. 2.—Ameloblastic layer just before amelogenesis; showing absence of basal ectoplasmic zone; terminal bars on both ends of ameloblasts; increase in number of enamel globules. (Other data as in Figure 1.)

Mummery (1916) formulated a theory which is much like that of Williams (given below), except that the interprismatic substance is believed to arise by "fusion and disintegration" of the block-like masses forming the prisms.

later fuse with one another. The originally distinct boundaries between the honeycomb and Tomes' processes disappear and calcification is effected by Tomes' processes. It progresses from the processes peripherally and produces a prism consisting of an axial calcified portion surrounded by a much, little or not at all calcified cortical portion, this depending on the amount of calcification.

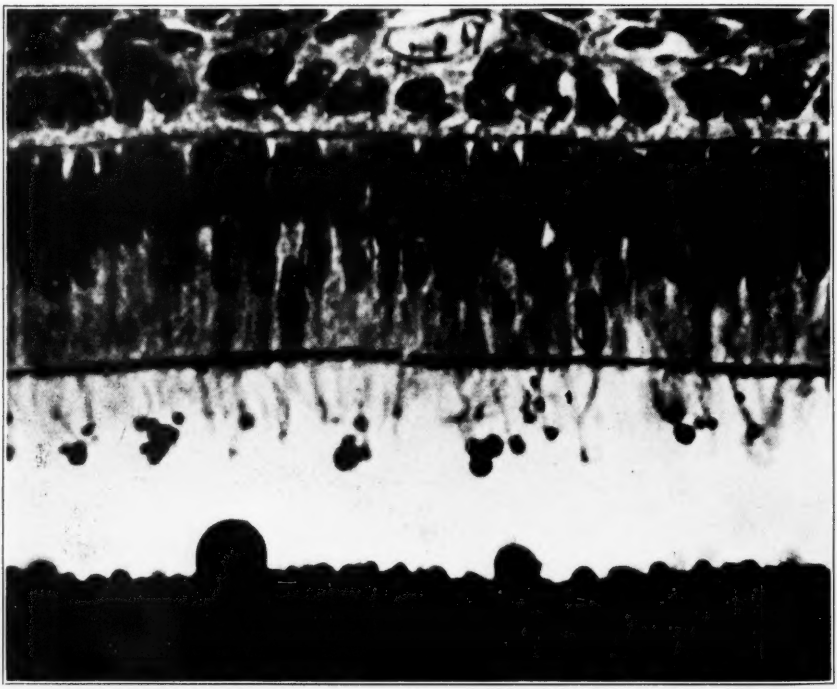

Fig. 3.—Ameloblastic layer separated from forming enamel; material of interprismatic substance in globules between ameloblasts and enamel. (165 mm. pig; Bouin's fluid; trichloracetic acid; hematoxylin and eosin; ×1,000.)

THEORIES INVOLVING BOTH CONVERSION AND SECRETION

According to Williams (1896), granular, globular bodies, quite distinct from the masses of material forming the interprismatic substance, are formed by the nucleus of the ameloblast. These, the enamel globules, fuse to form discoidal or blocklike masses of spongioplasm, which fuse or almost fuse with one another serially, united by longitudinally running "plasmic strings," to form the prisms. Then, an albuminoid substance bearing calcium salts (the calcoglobulin of Harting [1872]) flows around the columns of blocklike masses to form the interprismatic substance and furnish calcareous material for the calcification of the whole enamel.

The theory of von Ebner (1922) is usually referred to as a secretion theory. Since it involves conversion of at least part of the ameloblast, it must properly be classified in the conversion-secretion group. According to this conception, the cytoplasm of each ameloblast becomes transformed basally into a homogeneous mass like a cuticula. This becomes confluent with the masses formed by the other ameloblasts. Secondarily, and within the cuticula, a fibrous substance is formed in direct continuation of the ameloblast. In this ameloblastic process, granular deposits coalesce and calcify provisorily to form a young prism. The prism increases in size at the expense of the uncalcified homogeneous cuticular substance, which forms the interprismatic substance.

Prénant (1914, 1924) regarded the ameloblast as a ciliated cell. Tomes' processes and their fibrils are, according to his theory, artefacts. By the cilia and by the continuously growing terminal bars of the ameloblasts, materials are conducted to their destination to form, respectively, the prisms and the interprismatic substance.

Eklöf (1915), cited by Lams (1921) and Jasswoin (1924), concluded that the enamel globules (von Spee's enamel-drops) form the interprismatic substance,

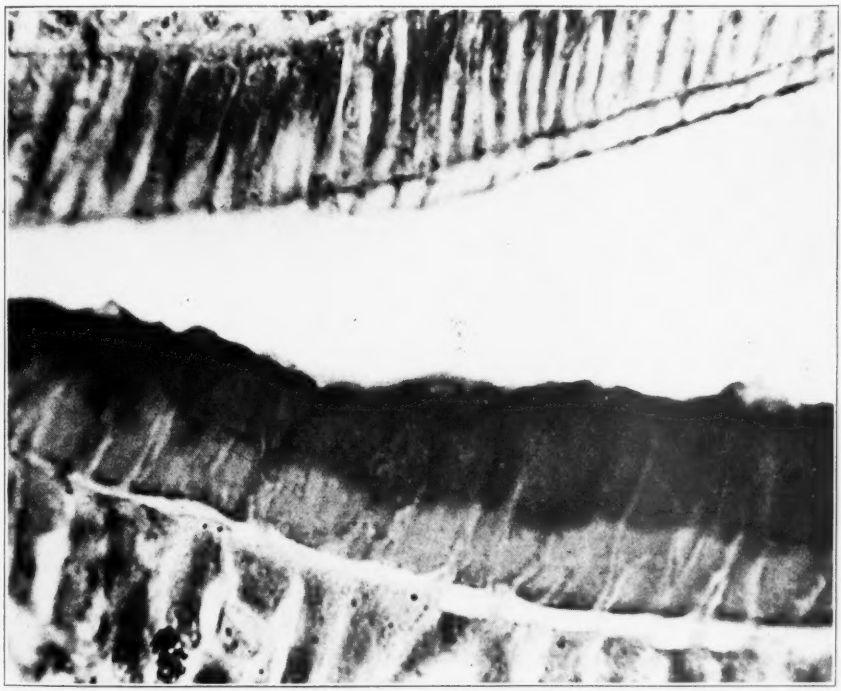

Fig. 4.—First layer of enamel, adherent to dentin (on left); attached to Tomes' processes (on right). (165 mm. pig; Carnoy's fluid; formic-formol; hematoxylin and eosin; ×1,000.)

the prisms arising by the deposition of calcium salts in the organic basis of the ameloblastic processes.

Nishimura (1926) described a structureless preenamel, deposited by the ameloblasts. Into this material, the ameloblastic processes grow and form tubular structures (*Schläuchen*). Within these, enamel globules form and fuse to produce the enamel prisms. The material surrounding the tubular structures becomes the interprismatic substance. The cell membranes become the prism sheaths.

Stein (1930) proposed a theory according to which a cuticula is formed as in von Ebner's hypothesis. This cuticula grows on its distal side. On its basal side, it produces the ameloblastic processes, the ends of which calcify progressively to form the prisms. At the conclusion of amelogenesis, the distal, nucleated ends of the ameloblasts also calcify. He did not explain the origin of the interprismatic substance, but mentioned that it is calcified.

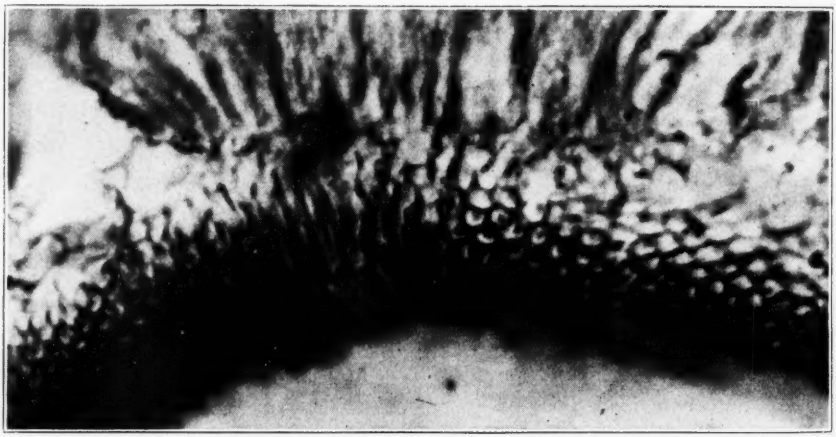

Fig. 5.—Oblique section through young interprismatic substance; Tomes' processes in many "cells of honeycomb." (105 mm. dog; Carnoy's fluid; nitric acid; hematoxylin and eosin; ×1,000.)

ENAMEL ENTIRELY FORMED BY SECRETION

Formation Without the Presence of a Membrane.—Andrews (1919) believed that, in early stages of amelogenesis, small globules of semifluid calcoglobulin, the calcospherites, are formed in the ameloblastic cytoplasm. These first appear near the nucleus, increase in size by coalescence toward the basal end of the cell and are deposited, globule by globule, fusing in a fibrillar framework, to form the prisms, and, without a fibrillar framework, to form the interprismatic substance.

Schaffer (1920) described the deposition, by the ameloblasts, of a soft mass on their basal surface. This mass is soon differentiated into the ameloblastic processes, as the anlagen of the prisms, and into the interprismatic substance.

According to Lams (1920; 1921), secretion globules expelled from the ameloblasts form, by their confluence, the enamel prisms seated on the ameloblastic processes. The interprismatic substance

is derived from the enamel pulp and passes through the terminal bar apparatus of the ameloblasts to form the honeycomb before the prismatic substance is secreted.

Formation in the Presence of a Membrane.—Kölliker (1867), who had earlier believed in the conversion theory, by this time, according to Bödecker (1894), altered his views, coming to believe that the enamel is a cuticular secretion through the membrana praeformativa, of Huxley (1854-1857).

Studnička (1917) described the outgrowth of numerous fine cytoplasmic processes (intercellular bridges, his *Cytodesmen*) from the bases of the ameloblasts before amelogenesis begins. Between the ameloblasts and the surface of the dentin, these processes unite to form a complete lamina of "extracellular cytoplasm," which he considered identical with Huxley's preformative membrane. A cytoplasmic network is formed by the intercellular bridges between this membrane and the dentin. In the preformative membrane, and in the cytoplasmic network, Tomes' processes (which have meanwhile appeared) deposit organic, then inorganic formative secretion (his *Bausekret*), to form the preadamantine layer. The organic component is derived from the enamel globules. From the beginning, the prisms are encapsulated by prism sheaths, the origin of which he does not explain. Between the prism sheaths, the rest of the extracellular cytoplasmic network becomes impregnated with calcium salts. He considers it probable that the prism sheaths become the interprismatic substance.

In the opinion of Held (1926), two ectodermal cytoplasmic membranes are formed which are basal to the ameloblastic layer. One of these, the membrana limitans epithelii prima, is formed at the basal end of the ameloblasts, and apparently coincides with the terminal bar apparatus; the other, the membrana limitans epithelii secunda, forms by the divergence and union of the ends of the ameloblastic processes. By anastomosis, the ameloblastic processes cross the space between the first and second limiting membranes. Granules arising in the dis-

Fig. 6.—Young interprismatic substance cut in plane perpendicular to surface of enamel; amorphous mass of prism substance (?) in region where ameloblasts have been damaged. (105 mm. dog; Carnoy's fluid; nitric acid; hematoxylin and eosin; ×1,000.)

tal (nuclear) ends of the ameloblasts produce vacuoles filled with a clear substance which contains numerous darkly staining granules. The vacuoles fill the ameloblastic processes, which then become the prisms. Amelogenesis is, according to Held, entirely an intraepithelial process. The ameloblasts are to be regarded as glandular cells secreting through their basal ends.

drops of prism substance, elaborated by the ameloblasts as a fluid containing all the elements of the prisms. Tomes' processes are artefacts representing collapsed prism membranes. The interprismatic substance arises from the fluid intercellular substance of the ameloblastic layer. It receives calcium salts from the prisms, provided sufficient salts are available after the prisms themselves have been calcified.

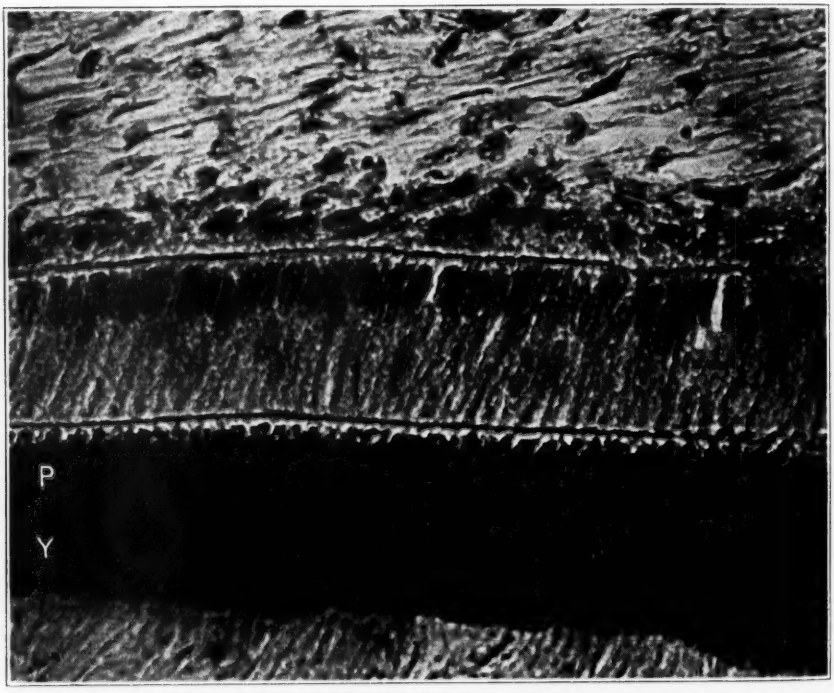

Fig. 7.—Primary (*P*) and young (*Y*) enamel; deciduous molar of human fetus at term. (Formol; formic-formol; hematoxylin and eosin; ×600.)

Göllner (1930) recognized the second limiting membrane of Held. According to his theory, thickening of the peripheries of the basal ends of the ameloblasts produces tubular prism membranes. These become filled by a succession of

ENAMEL FORMED WHOLLY OR IN PART BY THE ODONTOBLASTS

In recent years, theories which regard the enamel as wholly or partly of origin from the dental papilla have become increasingly numerous. Representative

theories of this school are briefly outlined below.

Retterer (1919, 1920, 1925) believed that the enamel represents the last developmental stage of the outer layers of the dentin, becoming converted from dentin to enamel under the influence of pressure.

Weidenreich (1926) held a belief of similar nature, though not so radical. According to his views, based on phylogenetic studies, the enamel is fundamentally nothing other than the specially differentiated outer zone of the dentin. There is a component derived by secretion of materials from the ameloblasts through a basement membrane.

Schöttl (1928) inclined toward the view that both enamel and dentin are formed by the odontoblasts.

Kato (1929-1930) proposed the theory that a fundamental enamel matrix, secreted by the ameloblasts, receives lime salts from the odontoblasts. Odontoblastic processes form enamel fibrils, and dentinal tubules continue into the enamel as the enamel tubules. The enamel is formed by the cooperative work of the ameloblasts and odontoblasts. The morphology of the enamel is interpreted by Kato in terms of enamel tubules and enamel fibrils.

Allen (1930) formulated a somewhat similar view, apparently based entirely on the study of formed enamel. According to his theory, "The enamel of human teeth is neither columnar nor rodlike in structure, but, on the contrary, consists of an intricate system of spiral tubules . . . of mesoblastic origin."

Finally, Loher (1929, 1931) investigated the enamel of bats by advanced optical methods and described the enamel prism as consisting of a fine fibrous and meshed skeleton of ameloblastic origin, surrounded by a fibrous sheath derived from the dentin. He stated that a filament wound spirally around the fibrous sheath, and an axial fiber giving off fine branches, which might end in little knobs within the prism, were both of odontoblastic origin. The prisms were said to be imbedded in a matrix of ameloblastic origin. In his last paper, he described in addition exceedingly fine spirals in the wall of the above-mentioned spiral filament.

AUTHOR'S INVESTIGATION

My own investigation of the histogenesis of the enamel has been made on material including the developing teeth of man, dog, cat, pig, rabbit and rat. The material was fixed in Zenker's fluid, Zenker-formol, Carnoy's fluid, Sanson's modification of Carnoy's fluid, 10 per cent formol, trichloracetic acid or Bouin's fluid. Decalcification was effected by from 1 to 3 per cent nitric acid, formic-formol or trichloracetic acid. Embedding was usually in paraffin, but, for large blocks of tissue, celloidin embedding was used. Sections were cut of various thicknesses, ranging from 5 to 25 μ (for some large specimens in celloidin). Staining methods included the hematoxylin and eosin, Heidenhain's iron hematoxylin and fuchsin, Mallory's connective tissue stain, Unna's water-blue and orcein and the methods of Dreysel-Oppler, Pasini, Buzzi and Bielschowsky.

Methods giving the best results have been: fixation in Sanson's modification of Carnoy's fluid followed by decalcification in nitric acid, and fixation in Bouin's fluid followed by decalcification in formic-formol.

My description of the histogenesis of the enamel will begin with the stage immediately preceding the formation of the first dentin. (Fig. 1.) At this stage, the ameloblasts have not yet attained their

full length, yet they are tall columnar cells about six times as high as they are wide. The nuclei are in the later stages of their migration from the basal to the distal ends of the cells. Some of the nuclei have reached their definitive position, but most are in the distal half of the cells, and only a few remain in the basal half. (In the rabbit, many nuclei remain in the basal half.) The ameloblastic cytoplasm is coarsely granular and is acidophilic, although it contains a few basophil enamel globules (the enamel drops of von Spee [1887]). The distal ends of the cells are already provided with their terminal bar apparatus, but the basal terminal bars have not yet appeared, and there is as yet no indication of the ameloblastic (Tomes') processes. The cytoplasm in a zone of a thickness of 2 to 4 μ at the basal ends of the ameloblasts becomes, at or just before this stage, different in appearance from the remaining cytoplasm. It acquires a dense, finely granular and more opaque character, with a somewhat basophilic staining reaction. (Fig. 1.) This zone is not a cuticula, since it is intracellular, but may be regarded as an ectoplasmic portion of the cells.

Throughout this period, before any dentinal elements have been formed, the ameloblasts are apparently in direct contact with the odontoblasts. I have never been able to discern a basement membrane or limiting membrane like those described and drawn by Studnička (1917), Held (1926) and Göllner (1930).

This boundary between the ameloblasts and the odontoblasts even at this stage shows the beginning of the festooned or scalloped contour of the dentino-enamel junction, the position of which is already determined by the interface between these two layers of cells. Later, the unevenness of the boundary becomes even more marked, at the stage of first dentinogenesis. (Fig. 2.) I am convinced that Orbán (1926) and Rywkind (1930) are correct in denying that absorption of dentin by the enamel organ plays a part in the production of the uneven contour of the dentino-enamel junction.

During the formation of the first layers of dentin, the basal ectoplasmic zone of the ameloblasts gradually disappears. As it becomes more and more reduced in extent, its appearance gradually assumes the character of the rest of the ameloblastic cytoplasm. (Fig. 2.) In all of the cytoplasm basal to the nuclei, the enamel globules have meanwhile become increasingly numerous. (Figs. 2-3.)

When the ectoplasmic zone has finally disappeared, the basal terminal bars become discernible. (Fig. 2, right.) I have not as yet been able to discover any relation of cause and effect between the presence and disappearance of the ectoplasmic zone and the formation of either the enamel globules or the terminal bars. The significance of this transitory ectoplasmic zone is worthy of further investigation.

By the time the basal terminal bars have been formed, the ameloblasts have reached their definitive size (in man and dog, about eight times as high as they are wide). Their cytoplasm now contains large numbers of enamel globules which imparts to the cell an increasingly basophilic appearance, although the cytoplasm between the globules still exhibits its acidophilic character. The ameloblasts are now ready for the first deposition of enamel.

The earliest recognizable stage of this process shows, not the homogeneous cuticula described by von Ebner, Schaffer, and Stein, but rather the ameloblastic processes, as short, blunt, acidophil ex-

tensions of the ameloblastic cytoplasm, isolated from one another by the intensely basophilic substance forming the so-called honeycomb (the interprismatic substance of most investigators), as Walkhoff (1927) maintained.

From the beginning on, Tomes' processes are acidophilic and longitudinally fibrillated. I have been unable to demonstrate the basophil enamel globules in their cytoplasm. They appear to contain rather a highly acidophilic, homogeneous, highly refractive substance, but in what form I do not know. That Tomes' processes are artefacts, as claimed by Prénant and Göllner, is scarcely to be credited in view of their constancy of occurrence and uniformity of appearance. That they represent collapsed prism membranes in the sense of Göllner's description is assuredly incorrect, since they never appear as hollow tubules when sectioned.

The interprismatic substance has the same staining reaction as the enamel globules that are found in large numbers in the ameloblastic cytoplasm during amelogenesis. This fact led Eklöf (1915) to conclude that the enamel globules form the interprismatic substance. In this view, I concur. In many preparations, particularly those which have been decalcified in organic acids, there are present, where the ameloblasts have been pulled away from the enamel, globules of a substance which resembles the enamel globules and the interprismatic substance in refractivity and in staining reaction. (Fig. 3.) These globules range in size from about 0.5 to 8 μ or more in diameter. The smallest globules are most frequently found nearest the ameloblasts, close to the bases of Tomes' processes. Stages of coalescence of small globules to form larger ones are found, and larger globules are sometimes observed fused to the interprismatic substance. The whole picture is such that it leaves little doubt that we are dealing here with a semifluid secreted product of the ameloblasts which, when it is poured out into the space between and around the ameloblastic processes, forms the interprismatic substance. It is probable also that here, as in other parts of the body where calcification is in progress, the intensely basophilic staining reaction of this substance signifies a content of calcium salts.

The foregoing conception of the formation of the interprismatic substance agrees particularly with that of Eklöf, but also in some degree with the ideas of several of the writers who have expressed theories belonging in the conversion-secretion group. That the secretion is in the nature of a cuticula in the sense of the theories of von Ebner, Schaffer and Stein is not to be believed, since, contrary to their view, it is deposited in the form of a honeycomb from the beginning, as Walkhoff (1927) has shown, and not in the form of a homogeneous cuticula from which, or in which, the ameloblastic processes are secondarily differentiated.

The conception of Lams that the interprismatic substance is formed in the enamel pulp and transmitted as a secretion through the stratum intermedium, distal terminal bar apparatus, intercellular spaces and basal terminal bar apparatus receives no support from my observations, since, as first von Spee (1887) and later Walkhoff (1927) and others have shown, the enamel globules are not demonstrable between the ameloblasts.

The hypothesis that the interprismatic substance derives from the extensions of continuously growing basal terminal bars, as championed by Orbán, Meyer and Prénant, I find difficult to believe. Besides the evidence presented above in

favor of the origin of the interprismatic substance by secretion of enamel globules, there is other evidence against such a theory. The relation of the interprismatic substance to the terminal bars appears that of contiguity rather than continuity, even in the most favorable preparations. The crests of the septums of the honeycomb of interprismatic substance are blunt and rounded in section (Fig. 6); also, they frequently show hemispheroidal masses which have every appearance of being the result of the recent fusion of globules of secreted substance with their ameloblastic surfaces. (Fig. 3.) Orbán's (1926) Figure 3, which purports to show direct extensions of the terminal bars into the interprismatic substance of a rat's incisor, can be interpreted in terms of small enamel globules located at the bases of and along Tomes' processes. (Compare my Figure 3.) Evidence in favor of such an interpretation includes the facts that Orbán's so-called terminal bars are doubled and even trebled along some of his "threads"; their large size; the resemblance of his "threads" to the cytoplasm of the ameloblasts and especially the fact, already commented on by Walkhoff (1928), that Orbán shows in his preceding figure (his Fig. 2) that he has undoubtedly and obviously mistaken Tomes' processes for interprismatic substance, and interprismatic substance for enamel prisms.

Regarding the membrana praeformativa, so often and so diversely described in the past, I am of the opinion that such a membrane, in the sense in which Huxley (1854-1857) first described it, is nothing more than a thin layer of newly formed enamel, as first John Tomes and later Williams (1896), Lams (1921) and others have maintained. In sections in which shrinkage or mechanical damage has pulled the ameloblastic layer away from the previously formed enamel, a thin lamina frequently adheres to the ameloblastic processes near their ends. Figure 4 shows the relation of such a "membrane" to the processes in the upper right portion. Other parts of this structure are shown still adherent to the dentinal surface, particularly opposite those regions of the ameloblastic layer where the "membrane" is lacking or incomplete. On examination through the microscope, this material bears striking resemblance to the first layer of enamel deposited.

Formation of a preformative membrane by lateral connections between Tomes' processes, as described by Studnička (1917) and Held (1926), was perhaps suggested by appearances similar to those just described. Studnička himself admitted that he had never directly observed the formative process.

Before the appearance of Tomes' processes, there is, in my sections prepared by the methods used by Studnička, no evidence of his intercellular bridges (*Cytodesmen*) or any other outgrowth from the basal ends of the ameloblasts. Studnička reported that his network of extracellular cytoplasm was best demonstrated by material fixed in corrosive sublimate (corrosive mercuric chlorid). Since he himself mentioned that his preparations did not show these structures at all clearly, it is possible that he dealt with the coagulation so often evident in the shrinkage spaces of sublimate fixed material.

Neither have I ever seen any indication of the distal processes of the ameloblasts described by Held (1926).

The formation of the enamel prisms takes place deep within the spaces in the honeycomb of interprismatic substance. This is assuredly a function of Tomes' processes, which are themselves probably incorporated in at least the axial parts of

the prisms. In serial sections passing in order from the ameloblastic layer into the developing enamel, or, better, in sections which pass obliquely through these structures, the appearance of the successive stages of prism formation is as follows. At the level of the latest formed interprismatic substance, Tomes' process lies within the hexagonal space enclosed by the interprismatic substance, but usually is separated from the interprismatic substance by what appears to be a shrinkage space. (Fig. 5.) At this level, the process has an acidophilic, somewhat granular appearance. Farther from the ameloblastic layer, the shrinkage space is no longer found in sections. Here, the appearance is that of intensely basophilic interprismatic substance enclosing a homogeneous, acidophilic substance in which the details of the ameloblastic process cannot be discerned. Still farther from the ameloblasts, the staining reaction of this substance changes abruptly from acidophilic to intensely basophilic, so that the boundaries between prisms and interprismatic substance can no longer be seen. Both prisms and interprismatic substance are here almost opaque, yet are sufficiently translucent to exhibit a granular appearance. This stage of enamel thus resembles closely, and probably is, the phase which von Ebner (1922) called primary enamel. (Fig. 7.) Again, considerably farther from the ameloblasts (from 20 to 40 μ in a human deciduous molar from a stillborn infant), the intense basophilic staining reaction is lost and replaced by a mild acidophilic staining reaction which characterizes a thick zone of enamel in which both interprismatic substance and prisms are demonstrable. This enamel is easily retained after almost any method of decalcification, and probably represents the phase which von Ebner called young enamel. (Fig. 7.)

This succession of stages suggests strongly that the formation of the enamel prism is by deposition of originally uncalcified substance within and around the terminal portion of Tomes' process, followed by stages in which calcification of this substance occurs. That Tomes' process is incorporated in the prism is indicated by (1) the fact that the processes, when pulled from the interprismatic substance, almost invariably present a broken, frayed appearance at the ends, as though they had been torn from an imbedding substance; and (2) the well-known demonstrability of longitudinal fibrils in formed enamel prisms (Williams [1896]).

Concerning the nature of the substance deposited as the initial prism substance, how it is produced and how deposited, I can offer but one other bit of evidence. In one series of sections of a developing tooth of a 165 mm. pig, the ameloblasts have been so damaged that they have lost at least the basal third of their cytoplasm. (Fig. 6.) Between the remains of the ameloblasts and the developing enamel, there lie first what appears to be the débris of the damaged cytoplasm; then, an amorphous mass of a substance which, by its homogeneous, acidophilic, refractive aspect, so closely resembles the initial prism substance that I believe it is such, freed from its parent cells by their rupture. If this is so, the initial prism substance must be deposited as a fluid, or more probably as a semi-fluid material, since the product of many cells can coalesce into such an amorphous mass as the one observed here.

Regarding the theories of the fourth group, that is, theories which ascribe an odontoblastic origin to part or all of the enamel, I must confess the utmost skepticism. At least, a well-defined layer of

predentin is laid down before amelogenesis begins. Before this, as Lams (1921) has shown, and as I can confirm, occasional odontoblastic processes may pass between the ameloblasts, but no more than are sufficient in number and extent to account for the enamel spindles and the short incursions into the enamel of tubules which do not form typical enamel spindles. Aside from these infrequent encroachments on the enamel arising before amelogenesis, the aspect after amelogenesis has begun, at least in the animals which I have studied, is that of complete separation of the two tissues by the dentino-enamel junction. The use of impregnation methods which demonstrate the finest branches of the dentinal tubules (silver impregnation; Schmorl's picrothionin method) gives results which confirm the observations made during the development of the teeth, for they demonstrate only a few tubules crossing the dentino-enamel junction; and these tubules, for the most part, are restricted to the enamel over the dentinal cusps. Choquet (1899), Thorsen (1917) and Van Kirk (1928) have all reported the occurrence of enamel which overlies cementum; a situation which would obviously preclude odontoblastic participation as a necessary factor in amelogenesis. That odontoblastic processes do come to lie within the enamel is not to be denied. That they participate in the histogenesis of the enamel in any fundamental way is, in my belief, an unproven assumption.

SUMMARY AND CONCLUSIONS

An ectoplasmic zone of problematical significance, situated at the basal end of the ameloblast, appears before dentinogenesis begins and completes its disappearance just before amelogenesis begins.

The basal terminal bars of the ameloblasts first become demonstrable immediately before amelogenesis.

The acidophilic ameloblastic (Tomes') processes, first appear at the inception of amelogenesis.

Coincident with their formation, the basophilic interprismatic substance is formed between Tomes' processes. It is probably formed by confluence of enamel globules secreted by the ameloblasts.

The interprismatic substance forms a mold shaped like a honeycomb, in the compartments of which a semifluid, acidophilic, highly refractive material formed by the ameloblasts imbeds the terminal portions of Tomes' processes to form the earliest stage of the enamel prisms.

Calcification of the prisms is secondary to their formation; whereas the interprismatic substance probably contains calcium salts from its beginning.

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ORALOGIC DIAGNOSIS*

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ORALOGY, as described by Dorland, is "the practice of medical and dental cooperation for health; health dentistry; mouth science."

Attention to this phase of dentistry is not only the privilege but also the duty of every dentist. It would hardly seem necessary today to stress this part of our responsibility but for the many cases we meet in which dentists have ignored the importance of eliminating oral infections and considered only mechanical restorations. The latter, when made on a poor foundation, have been the cause of failure, no matter how careful the technic of the superstructure. Robert A. Keilty, M.D.,[1] says that medical and dental cooperation should be sought, and each man should be responsible for his field alone, and neither should dictate to the other. I therefore will present my idea of what the dentist should do to uphold his part from a practical standpoint, reporting a few cases for your consideration.

We have two types of cases: first, the emergency type, and in these it is necessary to eliminate pain as soon as possible. Usually, these patients are not the type that will cooperate, and therefore it would be a waste of time to try to interest them in a thorough diagnosis. In the second type of case are patients who desire a thorough diagnosis, with whom only this paper will be concerned. These patients may be divided into three classes: those referred (1) by physicians; (2) by dentists, and (3) by former patients. At the first visit, full mouth roentgenograms are indicated. The smallest number of films practical, in my estimation, is fourteen of the regular type and five bite-wing. Frequently, these will have to be supplemented by extra-oral plates and bite films other than the bite-wing. Two smears of the gingivae are also taken at this time, one being stained for Vincent's organisms, the other by the Gram method. At the next visit, with the roentgen-ray and bacteriologic examinations at hand, the diagnosis may be completed. Not every patient suffering from systemic involvement following focal infection requires a physician's diagnosis: many are cured by oral work; but oftentimes the participation of a physician who is sympathetic toward dental procedures should be had. The dentist, in his work, is concerned with but three fields: the gingivae, or their extensions, as in paradental pockets; the apical and the cystic, which include unerupted teeth, and radiolucent and radiopaque alveolar areas. No one who does not consider all these three can be thorough in his mode of attack. There is much more to be considered in oral diagnosis than mere indications of abscess. It is customary in our office to combine all these areas in a diagnosis. In

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1. Keilty, R. A.: Gingivitis: An Infectious Entity, from Medical and Dental Aspects, J. A. D. A., 17:272 (Feb.) 1930.

diagnosing a case for the physician or dentist, a written report is always made. We try to give a true statement of the case at hand from a pathologic standpoint, and solicit consultation and advice before any operative work is begun, in order that definite plans may be made for the mutual benefit of all concerned.

A thorough clinical examination, consisting of a general survey of the mouth, includes the soft tissues and bone as well as the teeth. This will reveal missing teeth, loose teeth, open contacts, poor mechanical work, abnormalities, the condition of the gingivae, occlusion, abrasion and erosion. At this time, an electric pulp test is made of all the teeth, and a recording is made for each tooth according to the instrument indication for response from a minimal amount of electricity. We inform the patients that it is not necessary for them to be shocked to the extent of experiencing pain; that they shall inform us as soon as the slightest shock is felt. In this way, we are able to determine which teeth are normal and which are hyperemic. If any do not respond to the electric test, further investigation is necessary either by using heat or cold or even removing a filling or drilling a small cavity as far as the dentino-enamel junction. If multirooted teeth are under consideration, it is barely possible that we may find one or two of the branches of the pulp vital by test, the remainder of the pulps being devitalized. When a patient is suffering from systemic involvement, we feel that we should be very thorough in this work, and all teeth with questionable pulps should be condemned.

When the history of the case, which is a very much neglected factor in dental diagnosis, is taken, the patient is questioned in regard to tooth brushing and taping habits. Many cases of gingivitis, with the resulting sequelae, are traceable to lack of cooperation of the patient in systematic home care. The results of thorough eradication of all gingival lesions will not be permanent unless the patient is taught to maintain these conditions by home care. All periodontists are acquainted with this very important part of the work, but too often general practitioners overlook it. The history includes the age, weight and occupation; previous illnesses, operations and present illness; habits, such as of sleep, diet, regularity of bowel movements and exercise. The patient's occupation is noted in order that we may investigate any occupational diseases, such as metallic poisoning—lead, radium or phosphorus, etc. Inquiries should be made as to the family history in order to discover possible pre-

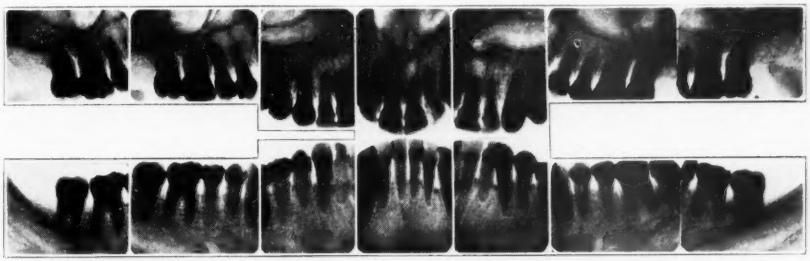

Fig. 1 (Case 1).—Full-mouth roentgenograms taken preoperatively.

disposition to specific diseases. This point was brought out by Dr. Shearer, of Omaha, on his recent visit to Los Angeles, as he cited a case of failure of years ago when he had neglected to get this information from a patient. Some dentists are taking up the matter of diet in their own offices and are accepting the responsibility for this very important part of daily routine. Some are doing it in a scientific way by checking up as to the alkalinity or acidity of the saliva and urine, as well as the amount of calcium and phosphorus. We have not made ourselves familiar with this method, and while we realize that, in certain cases, it does do a great deal of good, we feel that a great many diet cases need a more thorough investigation. This is particularly true where complications may exist in the alimentary canal; which can be definitely determined only by a physician especially qualified to diagnose such conditions. For the present, we are sending all our cases to men who we feel are competent to handle this work better than ourselves. Can you imagine a dentist giving roughage to a patient with a stomach ulcer?

Transillumination, as recommended for us to discern hyperemic areas in the gingivae, is of no value, as the roentgenogram will reveal this condition far better. It is a great aid in revealing small interproximal cavities, but especially is it indicated in all cases of involved sinuses and antrums in patients that have been referred by dentists and former patients. In the event any question arises as to the health of these sinuses, the patients are referred to the proper source for further checking, or the physician in charge is acquainted with the condition so that he may accept the responsibility. At this time, it is a simple matter to check the throat and tonsils for abnormalities, and these are handled in the same manner.

A complete set of dental roentgenograms is a necessary, nonreplaceable adjunct to diagnosis. In checking them over, we must remember that they have their limitations, and a man who uses a roentgenogram and gives an interpretation without using every other means of diagnosis is neglecting about 75 per cent of his duty. Teeth are divided into two classes, negative and positive, according to apical conditions. The fact that a tooth has a root-canal filling and is negative to test does not mean that that area is not to be suspected, because we are dealing with infection and resistance, and it is a matter of the virulence of the bacteria present; and where Nature has not walled off an area by a granuloma, this infection goes directly into the blood stream, is carried to all parts of the body and will reside in an area of lowered resistance elsewhere in the body, causing a specific condition in that area or organ. Again let me repeat: it is a problem of resistance against virulence of infection.

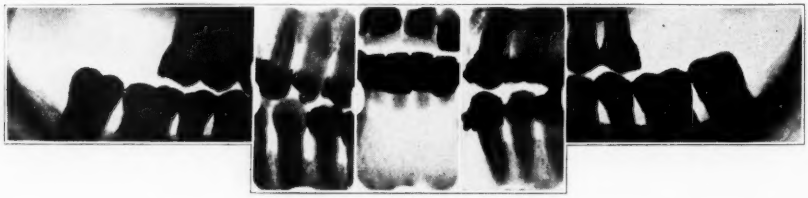

Fig. 2 (Case 1).—Bitewing films taken postoperatively.

The crest of the alveolar process should be checked thoroughly for resorption. Wherever the cortical plate has been resorbed, there is a possibility, in gingival infection, for toxins to enter directly into the blood stream, which is in a cancellated portion of the bone. Broken roots, foreign bodies, cysts and residual areas should be checked and noted. The last may be either the radiolucent or the radiopaque type. In the event a question is raised, by either patient or dentist, in regard to the retention of a devitalized tooth, the case is referred back to the physician, and if he will accept the responsibility for the retention of the tooth in question, we feel that our responsibility ends and our duty to the patient has been fulfilled.

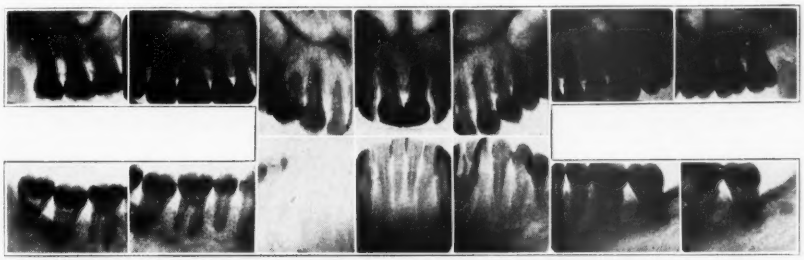

Fig. 3 (Case 2).—Roentgenograms taken preoperatively.

As previously mentioned, when smears are taken for bacteriologic examination, one is made for Vincent's organisms and the other for Gram organisms. Gram stains are not considered dependable for detecting Vincent's organisms; hence, the differentiation between the two. The organisms that we are particularly interested in are the pus cells, cocci, staphylococci, diplococci, streptococci, bacilli, streptobacilli, fusiform bacilli and spirilla of Vincent's. It is not a question of finding any of these organisms in the mouth, as it may be normal to find a few of any of them. When we find great numbers of the same type of organism, we believe that a pathologic condition exists, which should be eliminated before surgical intervention. It is impossible to place too high a value on this statement. We have found from clinical experience that postoperative treatments have been reduced to a very marked degree, with a pleasing result to both ourselves and the patient. We find today, in performing emergency operations, that when there is no time for preoperative medication, many old troubles return, such as dry socket, trismus and extreme after-pain. This work can be verified by reading the literature written by A. B. Vastine,[2] of Danville, Pa., and Robert A. Keilty, of Washington, D. C.[3]

If the gingivae give cause for us to suspect that a malignant condition may be present, it is necessary to make a histologic examination before we can proceed, and if the examination is negative, routine work may be established. A malignant condition calls for consultation with the proper authorities before proceeding. I have a case in mind which had been in the hands of more than a dozen men, who did nothing for the

2. Vastine, A. B.: Research in Subgingival Therapy, 17:507 (March) 1930.

3. Footnote 1, p. 279.

patient because of the suspicion aroused by the character of the gingivae. This patient was neglected for more than a year before a histologic examination was made. That it proved to be negative simplified the case to a point where surgical procedure was indicated, and a result was obtained in a short period of time.

If there is a question of referring a patient to a physician for physical examination, and the patient does not concur, it is possible for us to make a sufficient examination in our office to determine whether surgical treatment is indicated. This includes taking the blood pressure, pulse and respiration and making a Wassermann and a blood chemistry examination and a urinalysis. This is not routine work in our office, but is done in exceptional cases if the patient does not wish to have a thorough physical examination made by a physician.

With the foregoing information, the cases are classified into systemic and nonsystemic types. In the systemic type, the patient is referred to the physician for a thorough physical examination so that we may consult with him regarding the possible presence of a pathologic condition. If teeth are missing and a problem of mechanics is presented, the patient is referred to the dentist for study models so that the mechanical phase of the case can be attacked, as we realize that no patient can be thoroughly healthy without an efficient masticatory apparatus. In the nonsystemic types, consultation with the dentist is sufficient if mechanical work is to follow elimination of infection. These cases are further classified as simple or complicated. In the simple type, in which operation is not indicated but there is infection in the gingival areas, we eliminate the infection by subgingival therapy after the Vastine method, and in

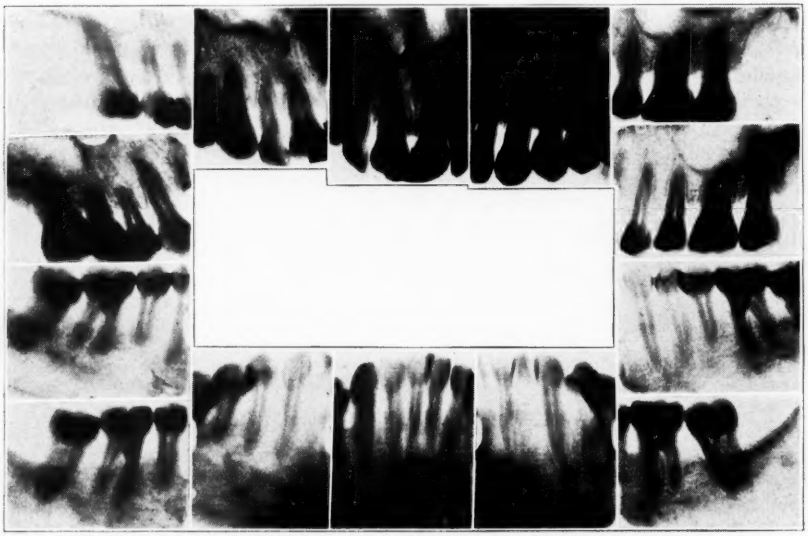

Fig. 4 (Case 2).—Roentgenograms taken postoperatively.

the event gross scaling is indicated in order to produce a more rapid result, this procedure is carried out as soon as clinical symptoms subside. After elimination of the superficial organisms, thorough scaling and polishing are done. The occlusion is then checked and adjusted, and the patient is taught the proper methods of brushing the teeth, massaging the soft tissues and taping the interproximal spaces, after Charters' method. If the patient cooperates and all mechanical deficiencies are corrected, he should be able to take care of his own mouth without further trouble, if the condition has purely a local origin, as the tissues will respond to proper systematic home treatment and recurrence of gingival infection will be nil, because of the good health and resistance of the gingivae, due to a proper blood supply.

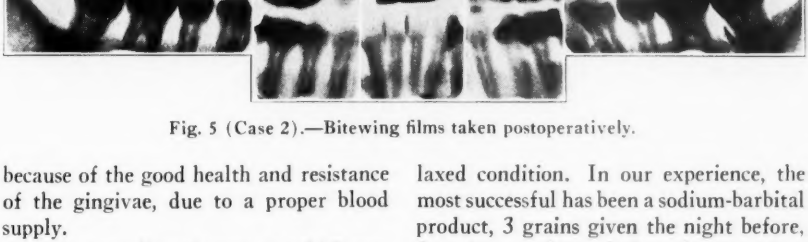

Fig. 5 (Case 2).—Bitewing films taken postoperatively.

In the complicated cases, in which surgical procedure is necessary, the elimination of superficial organisms is first indicated, in order that as nearly an ideal condition as possible be created before operation. Gross scaling is indicated if helpful in this procedure. By surgical intervention, I mean the eradication of all gingival pockets, curetting the crest of the alveolar process, extraction of questionable or devitalized teeth and the elimination of cysts, broken-off roots, foreign bodies or any residual areas. In some instances, in certain types of cases, after a dental survey has been made, we find it necessary to extract perfectly healthy teeth which may be a mechanical hindrance to an ideal dental restoration. By this, I mean teeth which are malposed either mesially, distally, buccally or lingually, or are elongated from lack of occlusion over a long period of time. Of course, this is done at the suggestion of the dentist, and with the consent of the patient. If the mouth has been treated in the manner suggested, namely, by the elimination of the organisms themselves or lessening of their virulence, the ideal method of procedure, to my mind, is hospitalization of the patient. If a case is hospitalized, the patient may be given one of the many forms of preoperative medicaments which will produce a relaxed condition. In our experience, the most successful has been a sodium-barbital product, 3 grains given the night before, 3 grains two hours before the operation, and 3 grains an hour and a half before operation; and an injection of morphin, one-quarter grain, and atropin, one-one hundred fiftieth grain, to be given one hour before the operation, is added when greater relaxation is desired. The age and temperament of the patient must control the dosage. This medication produces a relaxed condition in which the patient is semiconscious and can assist in the operation by holding the head in the most advantageous position and that position may be changed as the location requires.

This method gives the advantages of a general anesthetic, eliminating the surgical shock, and procain is then used to prevent pain. This gives us a clear field to work in without the cumbersome apparatus necessitated by a general anesthetic with the accompanying anesthetist present. A mouth may be operated upon under these conditions in its entirety, if this is indicated, without any fear of absorption from toxins or of postoperative infection. The patient leaves the surgical room in an ideal condition, without shock and with very little change in the pulse. Ice packs are applied immediately to both sides of the face, in the event both sides were operated on, and the patient will be relaxed for from six to eight hours, until the effects of the preoperative medication have worn off. Ninety-five per cent of all patients operated on in this manner leave the hospital the next day. A large percentage of these have no postoperative pain and do not receive as much as 5 grains of sedative, because it is not necessary.

In rare cases, when partial trismus occurs, the ice packs and infrared rays are used intermittently, with gratifying effect. All areas that were operated in by either the gingival dissection or the resection method, or a combination of the two, are covered with a zinc oxid-eugenol surgical cement. Where teeth have been extracted, the bone is cut back, all granulomatous tissue is removed and the flaps are freshened so that no epithelial tissues are brought in contact by sutures. This, in a majority of cases, will induce healing by first intention, and where extraction leaves narrow spaces between teeth, the surgical cement above mentioned is placed over the flaps where we feel that it is possible for the cement to remain without fracture. This is allowed to stay in place for a week, and the patient is given instructions to clean the oral cavity as well as possible with a physiologic sodium chlorid solution. The cement is then removed, and as soon as the soreness has left the soft tissues, thorough scaling and polishing of all remaining teeth are now indicated, the occlusion is adjusted and systematic home care as previously taught the patient is resumed. With

Fig. 6 (Case 3).—Hypertrophic gingivitis, Vincent's infection; lower anterior region.

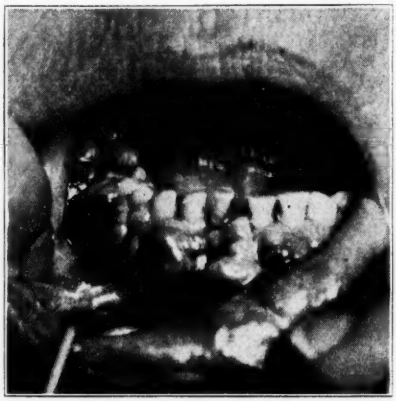

Fig. 7 (Case 3).—View of posterior teeth.

proper cooperation of the patient, the tissues soon toughen, and mechanical work can be begun within a few weeks' time.

You will notice from the foregoing suggestions that we do not adjust occlusion until the case is very nearly completed. We feel that a great deal of occlusal trauma, as I said three years ago in my paper read at the American Dental Association meeting in Minneapolis, is, in many instances, a result rather than a cause, because of the fact that the hyperemia brought about by the infection in the gingival areas progresses through the periodontal membrane to the apex, and the teeth are extruded as a result of this hyperemic condition in the periodontal membrane. After the hyperemia subsides, the teeth again resume their normal position in the alveolus. Any grinding of these teeth would mean a waste of valuable tooth structure, and a state of infraclusion would exist. We do not mean to say that it is never necessary to reduce an inflammation caused by an extremely traumatic condition. Above all, we should use judgment and not go according to rule.[4]

In summing up I wish to make it clear that the patient is our first consideration. It is not possible to work with physicians who are not inclined to sympathize with oralogic procedures any more than it is to work with dentists who have no conception of oral infection. Every angle of this work must be considered, including the pathologic, bacteriologic, histologic, osteologic and dietary. This must not be interpreted to mean that all these conditions are of moment in every patient, but they must all be considered and abnormal conditions eliminated. The elimination may be possible by means of subgingival treatment and prophylaxis, or any one of the combination, including deep scaling, gingival dissection, gingival resection, extraction, alveolectomy and cystectomy. If there are any teeth left,

Fig. 8 (Case 3).—Lower anterior region; mirror placed to show lingual surface.

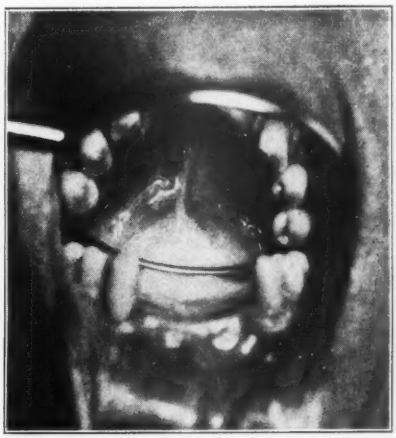

Fig. 9 (Case 3).—Postoperative appearance of region shown in Figure 8.

4. Footnote 1, pp. 273-274.

it is of utmost importance that the patient be taught how to care for them properly, and, without the patient's cooperation, a reinfection will occur in the gingival areas. After this work has been completed, reconstruction can be carried out which, if previously planned by study models, can be expected to afford good service over a maximum period of time, provided the patient cooperates.

CORRESPONDENCE

June 10, 1931.

Re: Mrs. A. L. C. (R. H.)
Oral Examination

Dear Doctor:

At your suggestion, Mrs. C. presented for examination on June 8, and we wish to make the following report:

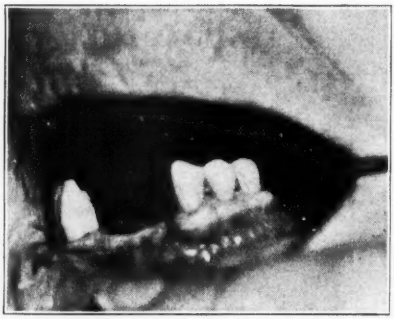

Fig. 10 (Case 3).—Postoperative appearance of lower left area.

Clinical Examination: The patient presents a well cared for mouth, in which there has been considerable restorative dentistry of a very high type, and on the face of the history and clinical findings, we feel that her systemic condition has no origin in the mouth.

Roentgenographic Examination: The roentgenographic interpretation shows all teeth x-ray negative apically, and the crest of the process is normal throughout with the exception of a slight amount of resorption in the upper right molar area. However, we will supplement these pictures with some of our own taken at different angles and may find a slight change from this.

Bacteriologic Examination: We understand that you have made your own bacteriologic examination of the gingivae and found a small amount of fusiform bacilli and spirillae of Vincent's. This may have some bearing on the case, but it is doubtful.

Vitality Test: Results of pulp testing present a more interesting angle. We find that the lower left first bicuspid, lower left lateral incisor, lower right lateral incisor, lower left second bicuspid, lower left first molar and the upper right lateral incisor are extremely hyperemic, inasmuch as they respond to very low voltage. This may be due to trauma, which will have to be corrected by grinding, and there is a possibility that this condition may be a stimulant and is creating the patient's general nervousness. The upper right first molar serves as a posterior abutment to a bridge supplying the second bicuspid, and it is extremely difficult to get any response from high voltage. There is a possibility that this being a multirooted tooth, it might have a portion of the pulp in one or two of the canals devitalized, with the other portion remaining vital—hence, the difficulty in making a diagnosis. The only possible way that this tooth can be checked up thoroughly would be to remove the inlay supporting the bridge, and, if you think there is a possibility of a dental focus, we will resort to this radical measure in order to definitely prove the status of this particular tooth. It is directly under the maxillary sinus and cannot be interpreted roentgenographically as being positive or negative, as it may possibly protrude through the floor of the antrum.

Conclusions: In the event you wish to treat this patient for a time at least in a conservative manner, we suggest that subgingival therapy be instituted in order to eliminate the infection above mentioned, followed by a thorough prophylaxis and enough lessons in home care to warrant permanent results. If you feel that the case should be treated more radically, we will be pleased to do so upon your suggestion.

Hoping that this letter will clarify the dental situation in your mind, and thanking you for this reference, I am

Very sincerely yours,
(Signed) FRANK KAISER.

June 11, 1931.

Dear Doctor Kaiser:

I wish to thank you for your very comprehensive report on the oral examination of

Mrs. C. The most baffling feature of Mrs. C.'s case are the recurring superficial ulcerations affecting the buccal mucous membranes and tongue. Her mouth presented such a well-cared-for condition that my early impression was against there being any local cause for these ulcers. She has a chronic intestinal stasis, which I thought very probably was a factor, and she is undoubtededly allergic, although studies of skin sensitivities made by other physicians have been inconclusive.

After a period of observation and treatment, however, in spite of considerable improvement in the intestinal condition, the ulcers continued to recur. I then made smears from the floor of a fresh ulcer and also from gingival pockets near the molar teeth. Smears from the ulcer were negative, but from the gingival pockets we found large numbers of spirilla and fusiform bacilli. From the numbers of the organisms and the appearance of the smear, it seemed to me highly probable that there were localized foci of infection. I prescribed sodium perborate mouth wash, and have since been unable to demonstrate any organism from the necks of her teeth. She has, however, had a few lesions of the mouth, although much milder and less persistent.

It seems to me, in a case as obscure as this, that we should remove any reasonable likely focus of infection. I do not believe anything but conservative measures are justified, however.

I shall be glad to have your further opinion after repeating the x-ray examination, and, in the meantime, believe that all subgingival pockets should be thoroughly treated and the mouth put in the best possible condition, so far as this can be done without radical measures. Your cooperation and further advice will be sincerely appreciated.

Very sincerely yours,
(Signed)

April 1, 1931.

Re: Mr. W. G. B.
Oral Examination

Dear Doctor:

Mr. B. presented for examination and consultation on March 31, and we are sending you the following report of our findings:

Clinical Examination: The patient presents a mouth in which all third molars are missing. The gingivae are soft, spongy and hyperemic, and bleed very easily on slight pressure. There is evidence that the patient has taken fairly good care of his mouth by home treatment, and the occlusion is fair, but the gingivae are suggestive of infection.

Roentgenographic Examination: This shows a slight resorption of the crest of the process all around, with greater resorption in the upper molar areas. There is an impacted upper left third molar immediately back of the antrum. All teeth are apically x-ray negative.

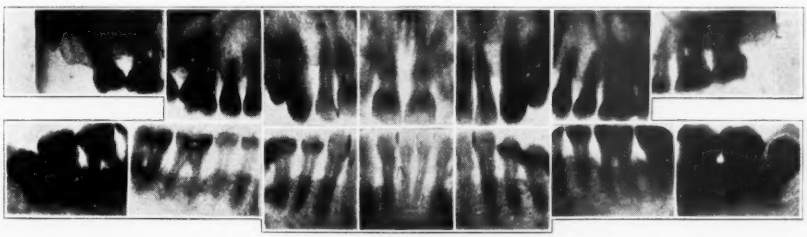

Fig. 11 (Case 4).—Roentgenograms taken preoperatively.

Bacteriologic Examination: Microscopic examination of a smear from the gingivae shows large numbers of pus cells, large numbers of gram-negative cocci, many streptococci (some twenty to forty in length), large numbers of fusiform bacilli, and large numbers of spirilla of Vincent's. Some of the fusiform bacilli are very large in character. Diagnosis: Mixed infection and chronic Vincent's.

Vitality Test: Results of pulp testing show that all teeth remaining are vital and normal, with the exception that they all respond to unusually high voltage.

Transillumination: All antrums and sinuses are clear by transillumination.

Conclusions: Inasmuch as the patient has a history of neuritis of the right arm and shoulder for six years, we feel that there is a very great chance that the gingival infection present may be responsible for this systemic involvement. We suggest therefore that subgingival therapy be used to clear up the infection, and then perform a gingival resection, which we believe should be done on the entire mouth. The impacted upper left third molar should also be extracted. It may be giving off a reflex, but should be taken out on general principles.

The prognosis is good with the exception of the upper left first molar, which may present a bifurcation. However, we feel that this tooth can be saved, and that by teaching the patient how to take care of the soft tissues by systematic home treatment, the danger from recurrence of this infection will be eliminated.

Thanking you for the courtesy of this report, I am

Yours sincerely,
(Signed)

Sept. 10, 1931.

Re: Mr. H. S.
Oral Examination

Dear Doctor:

We are sending you a written report of your patient, Mr. H. S., with the hope that you will advise us in regard to the suggestions we have made, for the benefit of the patient:

History and Clinical Examination: The patient gives a history of an asthmatic condition for the last year, of which you have already been acquainted. He was also wounded many times during the War, which may possibly be responsible for his present physical condition. Otherwise his general history is negative.

Clinical examination presents a neglected

Fig. 12 (Case 4.)—Roentgenograms taken postoperatively.

I would like to have you check this diagnosis and let me know at your earliest convenience if you have any further suggestions to make. The patient is waiting for your reply.

With best personal regards, I am

Yours sincerely,
(Signed) FRANK KAISER.

April 4, 1931.

Dear Doctor Kaiser:

I am pretty sure that your report of the examination of Mr. B. is thorough and has left nothing to be desired.

I believe that your suggestions should be carried out in accordance with the outline submitted to me, and feel that if you will take Mr. B. in hand, we would like to see just how much your efforts will do toward bringing about a complete cure of his troublesome ailment.

mouth, which we are inclined to believe is the result of poor dentistry rather than the fault of the patient. The gingivae are soft and spongy, present free pockets, and are suggestive of infection. There is a partial upper case, replacing the upper left bicuspids, upper right cuspid, first bicuspid and first molar. There is a bridge on the lower right, which is poorly constructed and very unsanitary. There is also a gold shell crown on the lower right second molar, and there are considerable calcareous deposits throughout.

Roentgenographic Examination: This shows slight resorption of the crest of the process throughout, with greater resorption around the lower left first molar, mesially and distally, and the upper anterior teeth. The lower left first molar is devitalized, has a partial root canal filling and is x-ray negative at the apex. The lower right first bicus-

pid, which is the anterior abutment for the bridge above mentioned, has a partial root canal filling and thickening of the peridental membrane, and we believe an absorption of the apex.

Vitality Test: Results of pulp testing show that the upper right second bicuspid is hyperemic, possibly owing to trauma created by malocclusion and the upper partial case which uses that tooth as an abutment. All other teeth are vital and normal with the exception of the devitalized teeth above mentioned and the crowned tooth, which could not be tested.

Bacteriologic Examination of Smear from Gingivae (By R. W. Hammack, at the Cedars of Lebanon Hospital): Gram stain: Many gram-positive and granular bacilli of the corynebacterium group; also gram-positive cocci and gram-negative bacilli; much stained amorphous material; only an occasional leukocyte or epithelial cell. Steamed gentian violet: Among the numerous bacteria are a moderate number of fusiform bacilli and a few spirilla. It is not a typical picture of Vincent's infection.

Conclusions: The patient presented with an extremely hyperemic upper left cuspid, which has a deep distal pocket in the bone and a thickening of the peridental membrane throughout, and from a clinical standpoint the vitality of this tooth was questionable. However, on electric pulp testing, after the acute inflammation had subsided to treatment, it responded normally.

In spite of the bacteriologic examination made by Dr. Hammack, we have diagnosed this as a Vincent's condition, and inasmuch as the patient has responded so nicely to treatment, we feel that our deductions are correct. We believe in making a thorough diagnosis and that we should not accept the responsibility as dental specialists for the retention of any devitalized teeth. We have therefore referred this patient back to you for a physical examination, with the hope that you will accept the responsibility for the retention of these devitalized teeth if they are allowed to remain in place.

We suggest subgingival therapy to reduce the above mentioned infection, followed by a thorough prophylaxis of all remaining teeth, the removal of the devitalized teeth, the removal of the bridge on the lower right side, proper reconstruction from a mechanical standpoint of these spaces created by extraction, and enough lessons in home care to warrant permanent results. Inasmuch as the patient is not in good financial circumstances, it may be necessary to compromise for the present, and we may only be able to eliminate the gingival infections, give him the prophylaxis which he needs badly, and the instructions in home care.

We have requested Mr. S. to consult you within a few days, and hope that you will give us your report so that we may proceed with our work as soon as possible.

Yours very truly,

(Signed) FRANK KAISER.

Sept. 28, 1931.

My dear Doctor Kaiser:

In reply to your recent letter concerning Mr. H. S. please be advised that it is my opinion, and I so informed Mr. S., that his oral condition was such that it required very energetic subgingival therapy and dental prophylaxis. Thereafter he was to form the habit of giving his mouth the proper dental care in order to prevent a recurrence.

Inasmuch as there was no remote focal disease which could have been attributed to the devitalized teeth I felt that there was no need for their extraction. Mr. S., too, was very much averse to their removal. Although they were apparently not doing him any harm, at the same time there was no question that in the future there was a possibility that the nonvital teeth might become foci of infection.

Should there be any other question concerning Mr. S. in which you feel my opinion may be of value, please be assured that you may call upon me.

Very truly yours,

(Signed)

July 10, 1931.

Re: Mrs. C. S. H.
Oral Examination

Dear Doctor:

Mrs. C. S. H. presented to us for examination on July 9, and we wish to make the following report of our findings:

Clinical Examination: The patient presents a badly infected mouth, the history of which dates back at least five years, at which time the patient had a few roentgenograms taken. The upper right first molar, lower right first molar and lower left second molar are missing and have not been replaced. The upper left first bicuspid and first molar have been

replaced by a bridge. The upper right central incisor, upper right first and second bicuspids, lower right lateral incisor, lower right first and second bicuspids and lower right second molar are loose. The lower right cuspid and lower left first bicuspid are very loose. The gingivae are hyperemic, soft and spongy, and upon digital pressure present free pus throughout which is of a thick, creamy consistency. The patient claims that her health is very good and that she has no chronic ailments or organic disturbances of any kind. However, we feel that with a condition of this kind, a physical examination is indicated, as we cannot understand how this case can be purely local with so much pus present.

Roentgenographic Examination: There is a resorption of the process in the upper left molar area and upper right molar area, with marked destruction around the upper right first bicuspid area, involving the mesial side to the apex. The lower left third molar shows a radiolucent area at the mesial root, and a rarefied area in the lower left second molar region, which is an area of recent extraction and may recover normally after a time. The lower left first bicuspid has a very deep pocket around it, having approximately an eighth inch of good bone at the apex. There is a rarefied area at the apex of the lower left cuspid, which is about a quarter inch in diameter. There is destruction of about half of the process of all the lower anterior teeth. The lower right lateral incisor has a deep pocket which involves the apex. The lower right second bicuspid has a deep pocket which involves about half of the process at the crest. The lower right second molar has a bifurcation involvement and a hyperemic condition in the peridental membrane throughout. The other teeth mentioned are of less serious character, although all seem to be affected.

Bacteriologic Examination: Microscopic examination of a smear from gingivae shows a moderate number of pus cells, a few gram-negative cocci, many gram-negative bacilli, many fusiform bacilli and large numbers of spirilla of Vincent's. Diagnosis: Chronic Vincent's infection.

Vitality Test: Results of pulp testing reveal all remaining teeth vital. The upper right first bicuspid is hyperemic, possibly owing to trauma. Many of these teeth have responded to very high voltage, and we feel that a general disturbance is present throughout.

Conclusions: We believe that the conclusions drawn on this case will depend greatly on the results of the physical diagnosis. There is a possibility that the six upper anterior teeth, and the upper second and third molars on both sides, may be saved and may give good service over a considerable period of time. The lower teeth present a more difficult problem, in that the mechanical aspect of the restorations involved will be very complicated. Most of these teeth are poor risks to use as abutments for any removable type of work, and it may be that in saving them only temporary results can be hoped for. There is a possibility of saving the lower left third molar, the lower left first molar, the lower left second bicuspid, the lower right first bicuspid and the lower right third molar. Before this work is definitely decided on, we believe the dentist who is to follow up should make study models of this case, and very careful and definite plans should be made, so that the patient may be assured that we are not just temporizing.

We are very much inclined to believe that the best judgment in this case would be to extract all of the teeth, and make a full upper and lower denture. We feel that eventually this will be the result, and that unless the patient is willing to experiment, and if her health will not be jeopardized by this experimentation, the latter is the best policy to pursue.

We know that Mrs. H. will not favor the latter diagnosis, as she is very anxious to save her teeth, but nevertheless very careful consideration should be given this before a definite program is arranged. We therefore hope that you will look at this matter in a very serious light and give her a thorough physical examination and advise us as to your findings.

We would be glad to cooperate in every way from an oralogic standpoint, and if we can be of any further service to you, we would be pleased to do so.

Very truly yours,
(Signed) FRANK KAISER.

July 14, 1931.

Dear Dr. Kaiser:

Thank you very much for your kind letter of July 10 regarding Mrs. C. S. H.

I have gone over her physical condition rather carefully and find that she has a somewhat lowered basal metabolic rate, minus sixteen, and an interesting blood count

of red blood cells, 2,500,000; white blood cells, 7,500; polymorphonuclears 62; mononuclears 38; and hemoglobin 77 per cent (Newcomer). The results of the examination were otherwise negative except for the oral condition. The appearance of the red blood corpuscles in a stained smear was quite normal. The question immediately arose as to whether we might be dealing with an early stage of pernicious anemia with the profound oral sepsis which we sometimes see in the beginning stages of that condition.

In view of the seriousness of the oral condition, the possibility of the beginning of a grave anemic condition, and the patient's fixed objection to the removal of any but the more patently abscessed teeth, I have suggested that she have an independent opinion and physical examination and she has today gone down to Dr. Percy White of the Moore-White Clinic for a check-up by him.

It is my opinion that if the laboratory findings of the blood picture are corroborated by him, Mrs. H. should have all of her teeth removed to do away with this serious oral sepsis which is the probable cause of her blood destruction.

I have told her that I would write you my findings and recommendations independently of Dr. White and that I would ask you to phone Dr. White for his opinion in the matter after he had seen her. She says she feels all right and cannot see why we urge such radical measures. I think perhaps an independent opinion by Dr. White will carry some weight and consequently I have urged that she get that opinion.

I expect to be leaving on my vacation on Friday of this week, so will not be able to help her much more, but I shall be very willing to abide by any decision you and Dr. White may reach in my absence. Thanking you very much for your letter to me and painstaking effort in her behalf, I am

Very truly yours,
(Signed)

Aug. 8, 1931.

Dear Mr. Kaiser:

I wish to thank you for your letter regarding Mrs. C. S. H. I made a complete examination of Mrs. H., July 14, 1931, and was unable to find anything seriously wrong in her general examination, especially anything pertaining to absorption from the teeth. She has a low grade secondary anemia, there being no evidence whatsoever of any pernicious anemia.

As to what you should do regarding her teeth I shall have to leave that entirely to your good judgment. She showed me the films at the time of my examination and my recollection is that there were two definitely abscessed teeth which undoubtedly should be removed. Any more extractions for mechanical reasons or for pyorrhea are entirely a question for you to decide.

I have not seen Mrs. H. since the day that I examined her.

Kindest regards,

Yours very truly,
(Signed)

REPORT OF CASES

CASE 1.—W. D., aged 29, unmarried, occupation, oil worker, height, 6 feet, weight, 158 pounds (normal for five years), Feb. 7, 1930, came in with an acute ulcerative gingivitis. A smear was taken and microscopic examination revealed Vincent's organisms. February 10, an area was lanced in the lower anterior region, which was opened to relieve pressure. A considerable amount of pus was released, but as the patient still had an acute Vincent's no attempt was made to curet. Daily treatments were given for Vincent's, and, February 14, it was again necessary to open the abscessed area previously mentioned, and a drain was inserted. The two days following, the patient had a temperature of 102 F., and was admitted to a hospital. After consultation, February 22, when the clinical symptoms had disappeared, it was decided to operate, removing all foci, which meant a full gingival resection and extraction of the upper right first and second molars, upper left lateral incisor, upper left first and second molars, lower right central and lateral incisors and lower left central and lateral incisors. A drain was placed in the lower anterior area, and, after daily treatments, the patient left the hospital, March 3. The patient lost approximately 25 pounds during his illness. February 7, 1931, when he was again seen, he had gained back his lost weight. There was also improvement in his general condition, with no more lesions and a negative smear. His mouth was restored by building up the occlusion and by supplying him with removable bridges.

CASE 2.—H. S. J., aged 35, housewife, referred by her physician, came in, Aug. 16, 1930, assisted by her mother and sister. She had been in bed for a week previous, was very weak and had no appetite. On attempting to

eat, she suffered from eructation, although there was no sour taste and no food regurgitation. She had taken considerable of a sodium bicarbonate preparation, which relieved the belching. There was chronic constipation and much flatulence, and the patient had taken frequent enemas because she felt that she was taking too many laxatives. She had had headaches in the back of the head, and stated that she had been extremely nervous and, for the past few months, a fear of losing her mind would come on in waves during the mornings. There was a taste in the mouth resembling that of copper. The patient was very tired, and required a great amount of sleep. The pulse rate was from 130 to 160, and for the past three months, there had been a loss of weight and strength. The weight at the time was only 103 pounds.

The patient had gone to a dentist periodically for examination and prophylactic care, which was evidently given in a very haphazard manner. She had no idea that her mouth was anything but normal because of the assurance that this dentist had given her from time to time. He had filled all of the cavities, and felt that his work was through at that point.

Physical examination by her physician was very thorough. The blood chemistry, kidney function and blood count were normal. Urinalysis and Kahn and Wassermann tests were all negative.

The dental clinical examination showed that the gingivae were swollen, hyperemic, soft and spongy, with pockets throughout and suggestive of infection. The tissues oozed blood and pus on slight pressure and the condition was suggestive of calcium deficiency.

Roentgenograms revealed slight resorption of the alveolar process throughout, with marked resorption in all molar areas. The upper right second and third molars were loose, and the upper left second molar was elongated owing to lack of function.

Microscopic examination revealed many pus cells, a large number of gram-negative cocci, a moderate number of gram-positive cocci, a few gram-positive bacilli, a few short chains of streptococci, a few fusiform bacilli and many spirilla of Vincent.

The patient was given subgingival treatments from August 18 until September 5, at which time a full gingival resection was performed at the hospital, and the upper right first and second molars, upper left third molar and lower right third molar were extracted. One week after treatments were started, the patient began to gain in strength and was able to come in the office alone. The disagreeable taste in her mouth cleared up, and she was able to retain food. She made an uneventful recovery and was dismissed from the hospital three days later, September 8, and after postoperative treatment, was discharged, October 13. She has improved greatly in every way, both mentally and physically, and now weighs 115 pounds.

CASE 3.—Mrs. R. C., a practical nurse, aged 52, height, 5 feet 3 inches, normal weight, 156 pounds, during the two and a half years of her present illness had lost 17 pounds. Her mother and father died at the age of 82, her grandparents at the age of 95.

Patient had had no previous illnesses nor injuries except influenza in 1919, and, thirty-five years ago, she had had what she called a nervous breakdown.

About two and a half years previously, the patient, while taking care of her mother, who had had a paralytic stroke at the age of 80, began to complain of burning pain and severe soreness of the mouth, which she treated herself with various medicines for about a year, when she had the several teeth extracted under a general anesthetic. Her mouth gradually grew worse, but she had no further treatment until her first visit to our office, Feb. 21, 1929, at which time a bacteriologic examination was made. Microscopic examination of the smear from the gingivae revealed many pus cells, a few gram-negative cocci and bacilli, many fusiform bacilli, often occurring in sheaflike clusters, and large numbers of spirilla of Vincent.

Treatments for Vincent's infection were given, Feb. 21, 22 and 23, and, February 25, a section of tissue was sent to the pathologic laboratory, the report on which was as follows:

Two irregular-shaped pieces of tissue from the mouth appear to be partially covered with epithelium which is superficially ulcerated. Microscopic examination: The specimen is made up of dense fibrous connective tissue arranged in interlacing fasciculi. It is heavily infiltrated with round and plasma cells, especially immediately beneath the surface epithelium superficially ulcerated. There is no evidence of malignancy. The histologic picture is that of a chronic inflammatory lesion.

March 4, the treatments for Vincent's in-

fection were resumed, and were given daily until March 13, when a gingival resection was performed on the upper right side from the central incisor to the second bicuspid. The treatments for Vincent's infection were given for twelve days after this, and, March 25, another gingival resection was performed on the upper left side, and the upper left second and third molars were extracted. Thereafter, postoperative care and occasional treatments for Vincent's infection were given for two and a half weeks, when a gingival resection was performed on the mandible, and the tissue and teeth were curetted and removed from the second bicuspid backward, on both sides. At this time, the four anterior teeth were also removed, and the patient was treated periodically until the pictures were taken, three months later.

During the period of treatment and operation, the patient lost 29 pounds, going to 110, although she had no discomfort nor pain from any of the operations. July 1, 1929, she had gained 35 pounds in weight, and at that time weighed 145 pounds.

CASE 4.—C. R. R., a housewife, aged 43, height, 5 feet 4 inches, came in for consultation, March 28, 1929. She had marked tremor of the head, and because of her nervousness at the table, had very little appetite. She was very much undernourished, and had lost approximately 40 pounds, weighing only 106.

She had had roentgenograms taken at the Mayo Clinic, March 4, 1929. A gingival smear was taken on her visit to our office, and microscopic examination revealed many pus cells, a few gram-negative cocci, many gram-negative bacilli, an occasional short chain of streptococcus and streptobacillus and many fusiform bacilli and spirilla of Vincent.

The roentgenograms revealed resorption of the process, practically one-half being resorbed throughout. The patient had lost the upper first molars when a child, and the second molars grew in their place. There were bifurcation involvements of the upper second molars and lower first and second molars, and distal impactions against the ramus of both lower third molars. There was considerable calculus present throughout.

Clinical examination showed that the gingivae were hyperemic, soft and spongy and presented deep pockets. The occlusion was far from normal; in fact, so much so that grinding, in our estimation, would have been of very little value.

A summary of the history taken by the patient's physician, March 26, 1929, is as follows: "No previous illnesses nor injuries except influenza without complications in 1919. She has always been well with that exception. About two years ago, she suddenly complained of severe pain in the bladder area, with frequency of urination, which started during an automobile trip. Since then, she has had a great deal of local treatment by a physician as well as an osteopath." This physician referred her to a dentist in checking for focal infection, which he suspected, but as the dentist looked only in her mouth and could see nothing abnormal, he complimented the patient on the condition of her mouth and even went so far as to tell her that he wished his teeth were as good as hers. After a series of treatments by her original physician, the patient lost confidence in him, and was referred by a well meaning friend to an osteopath, who further treated her without success.

The first week in March, 1929, the patient went to the Mayo Clinic for a physical examination, and in a thorough examination, they diagnosed her condition as a Class 3 chronic diffuse cystitis over the entire bladder, everything else being negative except for two tonsillar tags. The dental roentgenogram, according to their examination, revealed a marked pyorrheic condition, and the extraction of five teeth, as well as any others which did not respond to treatment, was suggested. Because of the tremor of the patient's head, she had a neurologic examination, and it was felt that it was a tremor of an essential type.

We will quote the conclusions of the physician whom she was referred to in Los Angeles: "In view of the septic tonsillar tag, as well as the abscessed teeth and pyorrhea, it seems advisable to consider them before carrying out any further procedure."

March 26, 1929, a urinalysis was normal in every respect with the exception of thirty to forty pus cells per high power field, and numerous gram-negative bacilli.

Subgingival therapy was started, April 2, and home treatment begun, at which time the patient was discharged temporarily in order that she might have the tonsillar tag removed. Tonsillectomy was performed, April 4, and the patient remained in the hospital the following week. This was probably due to the fact that her resistance was very low, and also that no preoperative treatment was

used to eliminate or lower the virulence of the infection present.

The patient again came in for subgingival therapy, April 20, and treatments were given daily until April 29, at which time she was hospitalized and elimination of all infection by gingival resection was carried out, as well as extraction of all involved teeth and impacted third molars, with preoperative medication of morphin and scopolamin in conjunction with 2 per cent procain. Two days after the operation, the patient was able to turn her head sideways, which she had been unable to do for the past three and one half years without pain. May 2, she was dismissed from the hospital, and she could have been dismissed the day before, but because she was from out of town, her discharge was delayed an extra day on general principles. May 10, she showed very marked improvement and had lost considerable nervous tremor. June 27, after having periodic postoperative treatments, she was dismissed and was sent to her dentist.

At this time, we had not been in the habit of testing all pulps, but, because of this case, it thereafter became routine in our practice. The patient's dentist suggested that we test the upper right central incisor for vitality. It was negative, but on opening the pulp chamber, we found a moist, gangrenous pulp. This was removed September 9, and the patient's mouth was reconstructed very nicely by mechanical restoration.

Periodic urinalyses were made, and, April 20, the day that preoperative gingival treatments were resumed, there was an improvement in the urine, with twenty to thirty pus cells per high power field. April 25, another urinalysis was made, with the same result. June 18, a month and a half after the surgical work was done, the urine showed a marked improvement, there being only from nine to twelve pus cells per high power field. June 27, the day that we dismissed the patient, urinalysis was negative with one cell per high power field.

A cystoscopic examination, made by the physician in September, revealed that all the ulcerations of the bladder had disappeared. In December another examination was made, and the patient was dismissed as permanently cured. She has had local treatments by her physician, but the credit for the elimination of the bladder condition is given entirely to the removal of foci of infection in the mouth and throat. The patient reports to our office periodically, and, at her last appointment, Feb. 12, 1931, she had gained 34 pounds, weighing 140. At that time it was apparent that she had fully recovered in every way, both physically and mentally.

SOME DIFFICULTIES IN MANIPULATION OF THE RIBBON ARCH MECHANISM AND SUGGESTIONS FOR THEIR SOLUTION*

By HARRIS W. McCLAIN, D.D.S., F.A.C.D., Chicago, Ill.

WHEN pioneer dentists discovered that teeth were not fixed in the jaws and that they could be moved into more favorable positions, the quest for methods for the correction of malposition of teeth began. The history of orthodontia is replete with records of trial and error, as one method after another was tried and found wanting. One of the reasons for the multiplicity of design in appliances which have been presented to the profession is the difficulty which each presents in the practical treatment of malocclusion. This may arise either from the limitations of the mechanism or from the inability of the operator to employ it efficiently. When the use of a mechanism

*Read before the Section on Orthodontia at the Midwinter Clinic of the Chicago Dental Society, Jan. 20, 1932.

is associated with the failure of a case in treatment, it is very easy to blame the appliance. It is a very human tendency, and probably none of us is exempt from it, to attribute our failures in any of the endeavors of life to some agency outside ourselves.

There is no doubt that a large percentage of the difficulties met with in orthodontia arise from inadequate case analysis and a failure to determine what is wrong and what, if anything, is to be done about it before treatment is undertaken. The cause of the condition, if it is still present, and the prospects of eradicating it, the general physical condition of the patient, his temperament and attitude toward treatment, the possibilities for cooperation or lack of it, are at least as important considerations as the type of mechanism to be employed in treating the case. There is plenty of evidence to warrant the statement that of the cases of malocclusion that have been treated unsuccessfully a large number should never have been started and would never have been undertaken had sufficient analysis been given them in the beginning.

After the orthodontist has made a thorough analysis of the case and carefully planned *what* he has to do, *how* it may be accomplished becomes a process of both elimination and construction. Any mechanism with which most of the treatment necessary cannot be accomplished should be rejected. On the other hand, a complicated appliance is not indicated when the correction is relatively simple. The appliance of choice should primarily be efficient in the application of force and possess the qualities of control and support of the teeth which require movement. In using any technic, a clear understanding of the principles involved and the mechanical ability to construct, apply, and adjust the mechanism according to these principles are essential. It is more desirable that an operator be master of one technic than that he may be able to use several methods without completely mastering any of them. Dr. Pullen[1] has well said:

> Relative to the selection of appliances for orthodontic therapy, there seems to be extant a desire for eclecticism, or the use of all the various types of appliances, which should be restricted to some degree; for, as the violinist or pianist is master of one instrument only, so the orthodontist should be the master of one type of appliance primarily before he attempts the mastery of half a dozen types of appliances to the detriment of his skill and ingenuity with the one.

It is reasonable to insist that anyone who adopts a technic should thoroughly study the principles which it involves and that he should become an adept in every step of that technic as it is presented. He should not introduce any modifications until every angle of the effect of these has been investigated. The contention that no modification of a given technic should be made is unreasonable and, if followed, would literally block all progress; for progress means change, although change is not necessarily progress. Common sense should be mixed liberally with scientific training and mechanical ability both in the general methods employed and in the treatment of individual cases.

I shall consider some of the difficulties encountered in the use of the ribbon arch and, as far as I am able, suggest measures for their solution. It is not the intention to discuss the complete technic of the ribbon arch mechanism, as this has been exhaustively described by Angle,[2] Strang[3]

1. Pullen, H. A.: Present Day Tendencies in Orthodontic Therapy, J.A.D.A., 15:677 (April) 1928.

2. Angle, E. H.: D. Cosmos, 58:969 (Sept.) 1916.

3. Strang, R. H. W.: D. Cosmos, 67:779 (Aug.) 1925. Ribbon Arch Mechanism, J.A.D.A., 16:2074 (Nov.) 1929.

and others. Neither is it the intent to criticize principles of treatment with this appliance. I have employed the ribbon arch as a standard appliance for treatment of all types of cases for over ten years. While there has been a gratifying percentage of success, there have been some failures and not a few difficulties in which the results expected from certain adjustments did not materialize.

Before undertaking this discussion, I wrote to about fifty orthodontists in different parts of the United States and I wish to acknowledge replies from a number of them. The replies indicate that these men have encountered difficulties with the ribbon arch which closely parallel my own experience with it. The suggestions offered, which in part have been borrowed from my correspondents, are presented in the hope that they may be of some value to those who have similar problems.

The difficulties in manipulation of the ribbon arch may arise in placing the appliance, in its adjustment during treatment and in the control of the forces which may be derived from it.

As the efficiency and control of the ribbon arch are dependent on rather rigid attachment to a comparatively large number of teeth in each dental arch, it is important that these teeth be accurately banded and that the brackets be in proper relation on the crowns of the teeth. This is not always simple, owing to the presence of crowded or rotated teeth.

The brackets as received are not uniformly placed in the center of the band. Sometimes, they are not at right angles with the edge of the band as they should be. For many teeth, the bands are too wide and complaints of irritation of the gingivae by bands are not uncommon. It is my custom to trim about 1 mm. from the incisal edge of the band material, that is, the edge at the open side of the bracket. As force is exerted on the teeth through the foot or gingival end of the bracket, the bands should not be trimmed on the gingival edge and should not be placed too far gingivally. If placed so that the ribbon arch will cross the tooth in about its middle third, when in the brackets, the bands will be correct for most cases. Practically, it makes little difference, except for appearance, whether the bracket is in the center of the crown of the tooth mesiodistally. If there is a slight rotation to be accomplished, it is sometimes an advantage to place the bracket nearer the margin which is to be moved labially. (Fig. 3, *b*.) The bracket should in all cases be placed parallel with the long axis of the tooth. Bracket bands should be so placed that they will be in a straight line when the teeth are brought into correct alinement and the open side of the bracket should always be toward the incisal edge. The upper and lower ends of the brackets are frequently sharp and so should be slightly rounded before cementing to guard against irritation of the lips and cheeks. The new right and left band-forming pliers will save anyone who will master the proper technic much time and trouble in fitting bracket bands.

Undoubtedly, many operators have experienced difficulty in fitting clamp or D bands. When these are used, the sheath should always be soldered on after the band has been fitted.

I have discontinued the use of the molar clamp band except in rare cases. This is a departure from strict ribbon arch technic, but it does not involve any change in principles and it affords an opportunity for additional control and support of the buccal segment of the arch, which will be described later. A properly constructed plain molar band carefully fitted directly to the tooth, festooned on

the mesial and distal aspect to a width of about 3 mm., will cause little if any irritation to the tissues. If carefully cemented, it will withstand any force or stress that these teeth should ever be called on to bear. The curvilinear sheaths, which, as they come from the supply house, are bent at an angle rather than a gradual curve, should be straightened and then bent to curve uniformly slightly more than the curvature of the buccal side of the molar tooth, before soldering to the band. A discarded screw section of a ribbon arch carrying a sleeve nut should be placed in the sheath while it is being bent. Proper placing of these curvilinear sheaths is one of the most important steps in ribbon arch technic, and carelessness in this detail has probably caused more difficulty in using this appliance than any other one thing. It is simpler to properly aline the curvilinear sheaths so that they will be in the same plane and that the flat inner wall of the sheath is parallel with the buccal surface of the tooth than to make bends in the arch wire to compensate for less accurate placing of the sheaths. Bear in mind that every bend in the arch wire complicates future adjustments.

After all of the bands are in place, the ribbon arch is annealed and adapted so that it will lie passively in the sheaths of the molar bands and in the brackets of all the other banded teeth. This initial adjustment is extremely important and should be the self-imposed test of every operator, to determine whether he is able to manipulate the appliance. The fitting of the ribbon arch has been so carefully described and so clearly illustrated by Dr. Strang[3] that nothing more need be said about it here.

In the application and control of force, the ribbon arch technic, owing to the flatness of the arch and the positive attachment to the teeth, involves factors which do not enter into treatment with round alinement wires. This has brought about difficulties which are, in part, due to thinking in terms of the older appliances and, in part, to misunderstanding the possibilities of the ribbon arch. By locking the anterior segment of the arch in brackets on bands on the incisor teeth, a new source of anchorage is created. The molars remain anchor teeth, but if this anchorage is employed in the same way as with round wires, it will often prove unstable. The additional anchorage on the incisors, which may be employed for any desired movement of the molars, is a valuable adjunct to intermaxillary or Baker anchorage in Class II cases, because it immobilizes the lower denture to a greater degree and furnishes a source of power for moving the upper buccal teeth backward. Although spring force has been mentioned as an important factor in the ribbon arch technic, it is practically not operative between brackets on proximating teeth because of the short span, but, in the longer sections, not supported by brackets, spring force may be so active as to become a menace if uncontrolled. The screw force is the same as is employed with round wire arches. In the ribbon arch technic, the screw as frequently employed as a "take up" after other adjustments as for an actual force in treatment.

Inherently, the ribbon arch possesses one powerful force quality which is not available in the round alinement wire. This force, torque, may be a factor of great value when properly controlled and a dangerous element if carelessly or improperly applied. In this technic, torque is a force which is exerted by the tendency of the ribbon arch to return to its original form when so twisted that its vertical plane forms other than a right

angle with its horizontal plane. A flat wire sprung into brackets on two teeth on a straight line would tend to bring them into the same vertical plane. There are a number of factors, either mechanical or physiologic, which complicate the problem of employing torque in treatment. The variation in size of the roots of the teeth and the difference in the amount of supporting tissue around them produces unequal reaction and thus modifies the effect of torque. When some of the teeth are not banded, there are unequal spans between brackets, and this must be

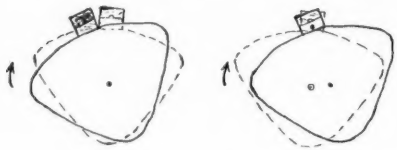

Fig. 1.—*A*, tooth rotated on own axis; *B*, tooth rotated by ribbon arch on center within bracket.

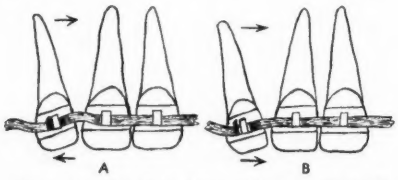

Fig. 2.—*A*, rigid cleat with U bends; *B*, nonrigid method of application of cleat.

taken into consideration in its effect on torque. As the arch wire follows the curvature of the dental arches and the curve of Spee, it may produce elevating or depressing movements instead of, or in addition to, the desired action which would result from torque exerted on a straight line.

In treatment with the ribbon arch, difficulties are encountered in correcting the malposition of individual teeth and in changing the position and relationship of groups of teeth. We may wish to intrude, extrude or rotate teeth, or to tip the crowns or roots, or move teeth bodily, and any of these changes may involve the opening or closing of spaces. Intrusion and extrusion of groups of teeth, such as incisors, are not difficult, and these movements in individual teeth are usually simple unless considerable rotation is necessary. The frequently desired simultaneous intrusion of incisors and extrusion of molars, in Class I and Class II, division 1 cases requiring opening of the bite, are accomplished very efficiently with the ribbon arch. In Class II, division 2 cases, this is not true in the upper denture because of the labiolingual inclination of the incisors. Here it is usually advisable to solder a section of 0.022 round wire

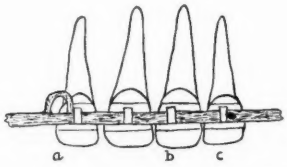

Fig. 3.—*a*, loop spring; *b*, offset bracket; *c*, stop soldered to ribbon arch.

into the incisor segment to replace the ribbon arch in the upper incisor brackets.

Rotation of anterior teeth is not simple with this mechanism. As the center of rotation is not the central axis of the tooth but the center of the bracket (Fig. 1), in a considerable rotation the axial center of the tooth is displaced. It is practically impossible to rotate a tooth directly on its axis with bracket bands; and converging or diverging of roots and the presence of too prominent mesio-incisal or disto-incisal angles of the crowns of the incisors are some of the results of attempts to do it. I prefer the plain band with spur and ligatures when any great

degree of rotation is necessary, followed by bracket bands for later adjustment.

Flattening or increasing the arc of the incisors by tipping the crowns labially or even by bodily labial movement of these teeth has a tendency to separate them, the crowns fanning out labially, with a tendency for the central crowns to be longer or the lateral shorter than they should be. Sometimes, there is a tendency for the roots to converge toward the median line or for the central crowns to separate and the lateral roots to diverge, which makes the distal angles of their crowns too prominent. This spreading

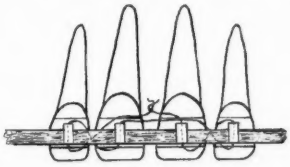

Fig. 4.—Method of lacing 0.010 steel wire through brackets to close spaces.

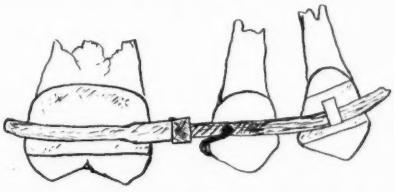

Fig. 5.—Spring of 0.022 wire soldered to ribbon arch to open space for second bicuspid.

tendency is caused by the resistance of the anterior teeth to the forward force of the screw. The arch slides through the brackets in the path of least resistance. Careful initial adjustment assuring that the incisor segment lies in a plane parallel with the buccal segments of the arch, that is, not dipping up or down, will tend to keep the length of the crowns equal. Labial root torque may restrain the tendency of roots to converge. In many cases, stops soldered to the arch distally to the lateral brackets (Fig. 3, *c*) and sometimes also distally to the central brackets should be placed in advance, or at least as soon as separation appears. When it is necessary to tip the crowns or roots of teeth mesially or distally with cleats, I prefer to set the longer leg of the cleat away from the bracket about 1 mm. (Fig. 2, *b*) and bend this leg against the bracket to bring the tooth to an upright position rather than to use compensated U bends in the arch with a rigid cleat. (Fig. 2, *a*.) The latter method opens spaces when the U bends are straightened; whereas, the former tends to close or minimize them. In closing existing spaces between incisors, the "kick," or small loop, spring (Fig. 3, *a*) described by Strang[3] is val-

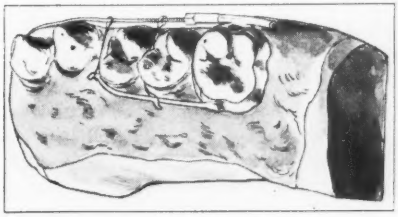

Fig. 6.—Lingual extension, stiff 0.036 round wire.

uable. I have used 0.010 steel wire laced through the brackets instead of pins with considerable success in closing these spaces. (Fig. 4.) This makes the bracket attachment less stable but does not cause the soreness produced by teasing the stops toward the median line to close spaces. For opening spaces between the central incisors and cuspids in the case of missing lateral incisors, I have found the kick spring valuable. For opening spaces between the bicuspids or between second bicuspids and molars, I have employed short finger springs (Fig. 5), soldered to the ribbon arch and bearing on the proximal surface of the teeth,

successfully in some cases. I have found loops between brackets or between a bracket and a molar sheath not easy to control. When all of the incisor teeth are inclined too far in one direction, a problem is presented for which we can offer no generally satisfactory solution with ribbon arch technic. The use of cleats may accomplish it in some cases. Another method which has been suggested is to solder a stop on the ribbon arch to bear against the lateral bracket on the side tipped away from the median line and an intermaxillary hook opposite the cuspid on the side tipped toward the median line, then, with screw force against the lateral stop and an intermaxillary elastic on the opposite side, these unfavorably inclined teeth may be, in part at least, brought upright. It must be remembered that the force derived from the screw is forward and that, as the arch wire passes around the cuspid, this force acts to drive the incisors for the most part labially and even when stops are used, only slightly toward the median line.

In the buccal segments of the arch, we have some of the same problems as in the incisor segment as far as the individual movements of teeth are concerned. From this segment too, we derive part, and often most, of the anchorage for the correction of malocclusion in the anterior segment. The replies of correspondents in all parts of the country indicate that the difficulty most often encountered in treatment with the ribbon arch is control of the bicuspid and molar teeth. The factors which enter into these difficulties are: loss of molar anchorage, expansion of the molars and bicuspids, and the tipping of molars and bicuspids distally in Class II cases. These, in turn, as far as the inherent resources of the appliance are concerned, are due to uncontrolled torque and to the impracticability of seating the arch in brackets on bicuspid bands, thus leaving the ribbon arch unsupported between the incisor segment and the molar.

Theoretically, in ribbon arch technic, all teeth are banded and, in early illustrations of the mechanism, models were shown with ten bracket bands and two molar bands in position on each dental arch. I believe that most orthodontists use bracket bands on bicuspids very infrequently. It is practically impossible to seat the ribbon arch in a second bicuspid bracket if the screw end carries a nut. It is next to impossible to seat it in a first bicuspid bracket without distortion if the tooth is even slightly rotated. These facts make it necessary to limit the use of bracket bands to incisors and cuspids in most cases and, in some cases, when cuspids are not erupted or cannot be banded, to the central and lateral incisors. This leaves a considerable span of the springy 0.022 by 0.036 wire, partly plain and partly threaded, unsupported between the cuspid or lateral bracket and molar sheath. This is the weakest section of the ribbon arch and the part which most frequently breaks during treatment. Either this section must be made less springy or it must be stabilized so that it may not exert undesirable force either through accidental bending or by vibration of "jiggling" during mastication. This intermittent backlash may be partly controlled by soldering a piece of 0.018 wire, slightly flattened, on the outside of the ribbon arch to stiffen it. Both soldered and removable lingual arches have been employed to stabilize the buccal segment of the arches for anchorage, but this links the two sides together and precludes their being moved separately by means of anchorage in the incisal segment, which is often desirable. While it is possible to control this buccal segment with ligatures

on the bicuspid teeth, it is frequently not practical to do so effectively.

I have employed a section of stiff 0.036 round wire soldered to the mesiolingual angle of the molar band, resting upon the lingual surface of the bicuspids, and ending in a hook lying in the lingual embrasure between the cuspid and first bicuspid. On this wire, a spur is soldered opposite the mesiolingual angle of the second bicuspid. (Fig. 6.) Wire ligatures may then be passed through from the lingual extension to the ribbon arch. The molar and two bicuspids are thus united in a group either as anchorage for use in moving other teeth or for group movement themselves. This lingual extension is not a new idea, but it is a modification of ribbon arch technic which has removed some of the difficulties in control and treatment of the buccal segments. When it is employed, this group of teeth may be moved mesially, distally, buccally or lingually and, in many instances, rotated quickly and easily during the adjustment of the anterior teeth. By means of the lingual extension and judicious use of the torque force, together with a widening of the ribbon arch, a very efficient method for the expansion of the bicuspids and molars is provided. It is equally satisfactory in mixed dentures when the deciduous molars are retained. The first permanent molar may be rotated by bending the arch wire just in front of the nut. It must be remembered that the ribbon arch must have greater expansion adjustment when the mesial angle is to be carried buccally and that this expansion adjustment must be omitted when the distal angle is to be carried lingually. With lingual extension, the bicuspids will be moved buccally, the first more than the second, by either of these adjustments for rotating the molar. In many cases, this is just what we wish to accomplish. By means of the ligatures passed between the teeth from the lingual extension to the arch wire, the bicuspids may frequently be rotated. These teeth can also be carried distally, either along with the molars or later, by the same method in Class II cases. Loss of control of molar anchorage is usually due to failure to estimate the relative strength of anchorage between the incisal and buccal segments or to take proper precaution in adjusting the ribbon arch for torque in the molar sheaths. It should be remembered that labial or lingual torque in the incisal segment results in an elevating or depressing force in the molars and that buccal or lingual torque in the molars results in an elevating or depressing force which increases from the central incisors to the opposite molar. Because of the preponderance of anchorage in the incisor segment, supported by the opposite molar, most of the torque is exerted in tipping the molar crown buccally or lingually or tipping its roots in the opposite direction. Through the incisor brackets, torque in the molar region manifests itself in a diminishing root torque in the opposite direction from that on the molar roots. Accurate placing of the sheaths on the molar bands and careful adjustment for torque, with the constant thought that the incisors are rigidly attached to the ribbon arch through the brackets, are essential in controlling molar anchorage.

It is sometimes desirable to employ loops in ribbon-arch technic. As a rule a V bend is easier to make and control than a U loop because of the flatness of the wire. To clear a high cuspid, a loop of 0.025 round wire may be soldered to the arch wire, the part between the legs of the loop being cut out after soldering. In adjusting such a loop, correction for torque on the incisors should be made when the loop is opened or closed.

Hooks for intermaxillary elastics should always be placed on the occlusal edge of the arch. If placed on the gingival edge, intermittent torque force is introduced, which is usually undesirable. When hooks, stops, spurs, cleats or springs are soldered to the ribbon arch or when repairs are made by soldering, it should be quenched immediately and then retempered. The arch wire should always be annealed for the initial adjustment and for any subsequent major adjustments. The whole arch should be heated when annealed and also when retempered.

By placing the ribbon arch on a sheet of plain paper and lightly tracing around it with a sharp soft pencil, a record is produced which will greatly aid in making adjustments. The arch should never be adjusted without being removed from the molar sheaths and brackets. The bands may be loosened, the brackets distorted and undesirable reactions introduced into the arch wire by such careless methods.

I have discussed some of the difficulties encountered in ribbon arch technic, and it is not within the scope of this paper to dwell on its virtues. I believe that it is a most efficient mechanism affording the maximum in control of force and support of the teeth during treatment and that it is especially valuable in complicated cases requiring a variety of adjustments. I am convinced that many have avoided it because of the exacting technic which must be followed in order to use it successfully. Every adjustment of a ribbon arch means that something is going to happen to the denture to which it is applied. Whether what happens is favorable depends almost entirely on the operator, how accurately he has analyzed the case, how carefully he has planned the treatment and how skilfully he has made the adjustments.

55 East Washington Street.

MAINTENANCE OF PARTIAL DENTURES, WITH INSTRUCTIONS TO PARTIAL DENTURE PATIENTS*

By ARTHUR PAUL LITTLE, D.D.S., Philadelphia, Pa.

THE maintenance of partial dentures so that, after insertion, they continue to serve as an aid in saving the remaining natural teeth, and, at the same time, act as satisfactory substitutes for the missing teeth, is the problem of every conscientious practitioner.

This paper has been prepared with my thoughts directed toward the failures that I have had in this branch of restorative dentistry, rather than toward the successes. It is the failures that bring forth analytic thought. Through analytic thought, knowledge is obtained. The solved problem soon fades from the mind giving place to new problems, and contributes little but the momentary satisfaction that goes with success.

In considering the maintenance of partial dentures, too often the first thought is that the problem is purely a technical one, that it has to do with mechanical procedure only. It is true that

* Read before the Section on Partial Dentures at the Midwinter Clinic of the Chicago Dental Society, Jan. 20, 1932.

actual changes, repairs and corrections are of a mechanical nature, but it is also true that nonmechanical factors, such as the diagnosis of the case, the management of the patient and a correct understanding as to how the various types of partial denture restorations aid in function after insertion, when correlated, make for successful maintenance. After a brief general survey of the partial denture problem, these topics will be considered in order to show their relationship.

The term "partial denture," in its strictest sense, implies all types of restorative dental work in the presence of any natural teeth. This presentation will be directed only toward the maintenance of those types of partial dentures that are removable.

Removable partial dentures are classed under two headings: the tissue-bearing partial denture, which transmits the load to the underlying tissue, and the tooth-bearing partial denture, from which the applied stress of mastication is distributed directly to the abutment teeth. This is accomplished through the medium of attachments or clasps with occlusal rests which are fastened at each end of the saddle or saddles, as the case may be.

The maintenance of the tooth-bearing type of partial denture is simple in comparison with the problems that arise when an attempt is made to keep the tissue-bearing partial dentures in harmonious relationship with the rest of the mouth.

An analysis of tissue-bearing partial denture construction shows that we are dealing with a more or less changeable condition, and that the changes which take place after the wearing of the dentures for a period of time are inevitable. In the past, we have thought of tissue-bearing partial denture construction too much from the mechanical side rather than from the functional side. Each case requires a different mechanical procedure, and the end-result is governed by our ability to choose such procedures as will best restore and maintain efficiency.

Every operator is familiar with the picture that the average tissue-bearing partial denture presents after being in service for a period of time. Certain changes in the underlying tissues permit the denture to settle. No matter how well the restoration meets the requirements in the beginning, in regard to its relationship to the remaining natural teeth, there will be produced on these remaining natural teeth, as a result of these changes, an overload which is bound to produce trauma to the supporting structures. The abutment teeth, that is, the teeth which carry the retaining agents, will be subjected to leverage that is not applied parallel to their long axis. Often, the retaining agent itself, when rigidly attached to the denture, will settle to a point where it exerts a pathologic influence at the free gum margin. If permitted to continue, this soon results in serious tissue and alveolar destruction. Any variation in the underlying structures directly affects the whole restoration. This means that the occlusal balance will suffer in direct ratio to the tissue change, especially after a recent extraction. Generally speaking, after a period of service in the mouth, these tissue-bearing dentures are in such a condition that they hinder, rather than aid, in the functional efficiency of the oral cavity.

DIAGNOSIS AND ITS RELATION TO PARTIAL DENTURE MAINTENANCE

Diagnosis, in itself, is a broad subject. Only that phase of the mouth survey that has a more or less direct bearing on partial denture maintenance will be considered.

Partial denture service, roentgenograms and study models of the mouth,

are first made, the study models being mounted on an anatomic articulator.

We then estimate, from the casts mounted on the articulator, to what extent the bite may be closed, determining whether this closure is causing impairment of the related physiologic functions. If, in the judgment of the operator, it is necessary to establish a new relationship of the mandible to the maxillae, the benefits derived can, as a rule, be more easily explained to the patient by the use of photographs of patients showing improvement in facial appearance after dentures have been inserted.

One of the primary concerns of the patient is his facial appearance. The dentist, when restoring the lost parts of the masticatory apparatus, knows that the facial appearance will take care of itself if the dentures are designed and constructed in accordance with anatomic requirements.

It is difficult to explain to the average patient the mechanical and technical steps necessary to produce partial dentures that will restore facial appearance. Illustrations are self-explanatory and will be found useful to the operator in showing the patient what can be obtained with a proper restoration; giving the patient an opportunity to visualize how impossible it is to restore facial contour without taking into consideration the amount of interdental space that has been lost.

Few patients have any working knowledge of anatomy and physiology. They do not understand that every part of the human body, including the masticatory apparatus, is developed to a certain height, nor do they understand that after loss of the teeth, the dental system undergoes marked retrogression; which naturally impairs the physiologic functions of the masticatory apparatus and causes severe atrophy to the muscles of mastication and expression, as well as to the neuromechanism.

We cannot expect the average patient to understand that these factors are essential, that they must be taken into consideration in the planning and building of partial dentures that are to restore facial appearance and masticatory efficiency.

Further, the average patient does not understand that if the teeth are not arranged in a manner to secure balanced occlusion, it will be impossible to reproduce the natural masticating movements of the mandible; nor do they understand that, without proper mandibular movement, it is impossible to obtain complete muscular activity. (Lack of muscular activity produces disuse atrophy.) The patient does not understand the value of muscular activity as a factor in restoring muscular tone, nor does he know that muscular tone is absolutely essential to proper facial appearance.

One point on which the patient and the dentist have a better understanding is the matter of facial appearance.

The use of photographs is a quick method of showing the patient just what the dentist desires to accomplish in the restoration without going into the more complicated fundamental and technical side of partial denture service.

Addison K. Parks, of Montgomery, Ala., recently gave to the dental profession the results of several years' research work in a paper entitled "Lost Vertical Dimensions." In this paper, and in subsequent presentations, Dr. Parks shows how, when the interdental space is shorter than normal, as the bite continues to close, from any cause whatsoever, the mandible moves or arcs forward. As the ridges absorb, or as the bases settle into the tissues, we naturally have a shortening of the bite. Under such circumstances, the centric occlusion position will constantly shift

forward with each degree of closure. The rapidity with which the bite closes, after insertion of the dentures, will depend on how often we may find it necessary to regrind and rebalance the occlusion to keep the dentures comfortable and efficient.

The practical application of Dr. Parks' contribution to partial denture work, especially in more extensive restoration, will decrease the need for maintenance.

Cases in which closing of the interdental space is anticipated after the insertion of the denture, as after recent extraction, may often best be served by cuspless teeth. Cuspless or mechanical teeth, in these cases, will automatically accommodate the constant change in centric occlusion caused by the arcing forward of the mandible as the interdental space is shortened.

Since using cuspless teeth in connection with cases where the interdental spaces cannot be kept constant, I have observed that less resorption of the alveolar ridges takes place. While this statement is based on clinical observation only, I do feel that less trauma is transmitted to the alveolar ridge. This appears to eliminate much of the rapid resorption.

Returning to diagnosis: we next decide what remaining natural teeth can be used. From the roentgenograms, we check the ridges to make sure that root fragments and infected areas have been eradicated. Single isolated teeth (especially posterior teeth) are not permitted to remain at the expense of the occlusal or mechanical efficiency of the denture.

The presence of single isolated teeth, when opposing a tissue-bearing partial denture, always causes an unequal division of the applied stress. When, for any reason, isolated teeth are allowed to remain, we should instruct the patient to expect that maintenance will be more complicated.

The ridges are next examined. Broad, round or flat ridges will be less troublesome after the case is inserted than will narrow, sharp ones.

Dentures made shortly after an extraction will, after insertion, settle a great deal. This may cause overarch and lingual bars to impinge on the soft tissue. When upper partial dentures of the overarch bar type of construction are used shortly after an extraction, the bar should be kept away from the tissues. It is often a good plan to make these bars quite thick in the region of the median line of the hard palate, as this will permit a slight amount of relief in the event settling causes the overarch bar to impinge. The bar, when made thick enough, can be ground on the tissue side without the endangering of the denture.

When lower partial dentures of the lingual bar type are to be inserted shortly after an extraction, great care should be exercised not to place them too low or too near the lingual ridge.

We should always bear in mind that the maxillae remain stationary, and for that reason, during mastication, receive much more stress than will the moving mandibular dentures. Therefore, upper partial dentures of the tissue-bearing type should have bases as large as possible to receive this extra load.

INSTRUCTIONS TO PARTIAL DENTURE PATIENTS

The average patient reaches the stage where partial dentures are indicated, with little other dental knowledge than that based on his personal experience with such forms of fixed dental work fillings, inlays, crowns and bridges. We are all familiar with the difference between fixed and removable dental work, but the patient, unless we carefully explain these differences before beginning any part of the work, will usually expect the same

type of service from a partial denture that he receives from fixed dental work. Failure to instruct the patient as to these differences will lead to many misunderstandings.

We should avoid technical terms while instructing the patient. He lacks the background to understand an educational talk filled with dental terms.

Let us make certain that prior to construction of the case, the patient thoroughly understands that maintenance is a necessary part of partial denture service.

Today, the general public have been taught, through the various industrial agencies, that maintenance must be expected with practically everything they buy. Further, they also understand that the burden of that maintenance must be borne by the user.

When the problems involved in partial denture service are explained to a patient in a simple way, prior to the beginning of actual construction, and we have made sure that he understands the conditions existing in his own case, we shall have accomplished one of the important steps toward success.

It should be a routine procedure to ask a few related questions after a simple, direct explanation has been made to the patient of the problems involved in his individual case. The patient, through courtesy, often gives the impression that he has a clear understanding of everything that we have attempted to explain, when, in reality, owing to a lack of dental background, our entire talk has left him with little knowledge of his case. The answers, or lack of answers, to our questions will serve to demonstrate to what extent our educational talk has been effective.

When instructing a patient, we should have a thorough understanding that immediately after insertion, the dentures will not be a finished product, that adjustments must be made; which can be done only after a period of wear. Naturally, they will not be ready to use for mastication. As it would be bad psychology to merely put the denture in and not give reasons for not using it, we have a definite understanding concerning this period immediately following insertion. It is well to show the patient by some simple example which he will readily understand that it is impossible to adjust the occlusion properly until after the denture has settled in the mucosa and also that, until the occlusion is adjusted, it may be mechanically impossible to use the new denture. We try to make this example very simple.

For our own part, this delay in using the denture after insertion will have a more significant meaning. We know that all dentures of the tissue-bearing type do settle into the tissues. We also know that after insertion of the denture, the patient is extremely awkward. Further, we know that there is liable to be an impingement from overextended bases. I have found it very beneficial in starting a patient out with a new denture to merely use pressure exercises in centric occlusion after insertion. This accomplishes three things: 1. We obtain the desired adaptation of the base into the tissues. 2. If any portion of the base is overextended into the soft tissues, this fact will manifest itself in mild inflammation rather than in the characteristic soreness which we find so commonly after premature use. 3. This period, following the insertion of the denture, coupled with the exercises of pressure in centric occlusion, will serve to overcome a great deal of the awkwardness which each patient exhibits after insertion, and which acts to prevent him from giving us very much cooperation in the adjusting of the occlusion. This awkwardness,

when coupled with an attempt to use the unadjusted restoration, is often the direct cause of much discomfort to the patient.

I do not believe that it is possible finally to adjust the occlusion on an articulator, owing to the impossibility of transferring tissue resiliency to the articulator. Hence, the final adjusting must be done in the mouth, and it is desirable that we receive the cooperation of the patient during that step. The mere fact that we have warned the patient of his inability to use the denture properly for mastication places us in a satisfactory position on his return, if he has attempted to use it and has met with unsatisfactory results. On the other hand, without proper instruction, it is only natural for the patient to believe that after the insertion of the denture, he should be ready to masticate any and all food.

On the return of the patient, we find out what progress he has made and what must be the first adjustment undertaken. We should never attempt to make an occlusal correction if the bases have caused irritation, for, if there is much irritation present, they will not be properly settled into the tissues. If the bases are comfortable and the patient has become accustomed to the denture to the extent that it is possible for him to make the various voluntary movements of the mandible from centric occlusion, it will be time to check up and correct any cusp interference present. This, I believe, can most satisfactorily be done by spot grinding. At the same time, we learn what advice and guidance to give the patient until the next visit, this depending on the type of person with whom we are dealing, and the progress that he has made since the denture was placed in his mouth.

If everything has progressed satisfactorily, it is usually time to begin teaching him how to masticate. If he has not made satisfactory progress, or if the denture needed extensive correction at the time of the second visit, we may find it advantageous to continue through another period, using the same procedure as was followed during the period immediately after insertion. Until such time as the patient is comfortable with the denture in his mouth, we can hope for little efficiency as a masticatory aid.

This method of procedure, during the trying days which the patient goes through when first given the denture, has been a great satisfaction in the management of partial denture cases, and I feel certain that much misunderstanding has been avoided owing to this more logical and sane practice.

CONCLUSION

It may be said that no single factor in the field of partial denture service is more important than altering the restoration to offset any changes that may have taken place in the underlying structures. Without these alterations, the denture cannot continue to aid in function. The success of the operator in maintenance of the denture will depend largely on the cooperation that he receives from the patient. This cooperation cannot be fully secured in the absence of an intelligent understanding on the part of the patient.

RETAINED DECIDUOUS ROOTS*

By LOUIE T. AUSTIN, D.D.S., and EDWARD C. STAFNE, D.D.S.,
Rochester, Minn.

DENTAL roentgenograms of the teeth of adult persons occasionally reveal small radiopaque bodies situated in the alveolus between the permanent teeth. These bodies, which are usually round or elliptic, have a radiopacity similar to that of roots of teeth. They are almost wholly confined to areas

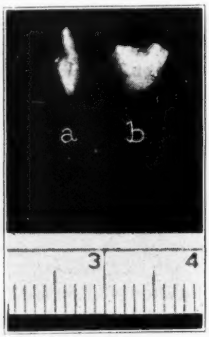

Fig. 1.—Deciduous tips of roots from the alveoli of adult patients.

approximating the second bicuspid teeth mesially and distally, and rarely are in mesial relationship to the first bicuspid. They are more common in the mandible than in the maxilla, the ratio being 4 to 1. They conform in size and appearance to the apex of the root of a permanent tooth, and not to the usual finely taper-

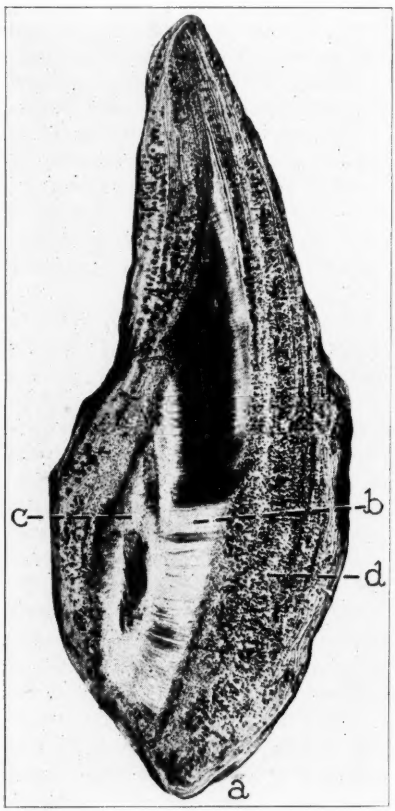

Fig. 2.—Longitudinal section of specimen in Figure 1, *a*. Preparation was made by grinding (unstained). *a*, apical end; *b*, dentin; *c*, root canal; *d*, hyperplastic cementum.

*From the Section on Dental Surgery, the Mayo Clinic.

ing, unabsorbed apex of roots of deciduous teeth (Fig. 1). Figure 2 is a longitudinal section of the specimen shown in Figure 1, *a*. A fragment of deciduous root is completely encapsulated by a thick layer of cementum which makes up the largest portion of the object. The many well-defined laminated layers of hyperplastic cementum which have formed account for the size and rounded or elliptic outlines of these specimens, as revealed by the roentgenogram.

same thickness as that found on the surface on which absorption has not taken place. Canaliculi and lacunae, which are characteristic of hyperplastic cementum, are in evidence.

A transverse section of the specimen (Fig. 1*b*) shows two root fragments which have become separated by absorption (Fig. 4). The fragments are encapsulated and held together by hyperplastic cementum of more irregular formation. The outer border of cementum

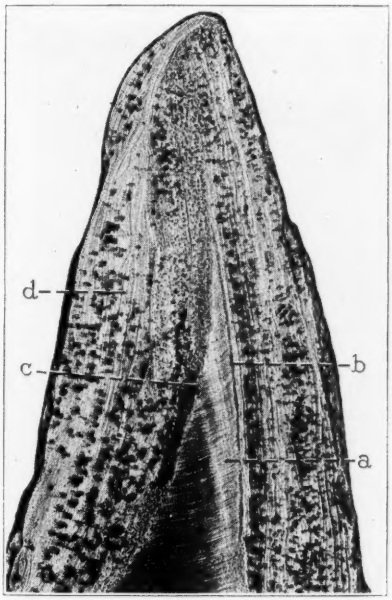

Fig. 3.—Coronal end of specimen in Figure 1, *a*. Preparation was made by grinding (unstained). *a*, dentin; *b*, layer of Tomes; *c*, surface of absorbed dentin; *d*, hyperplastic cementum.

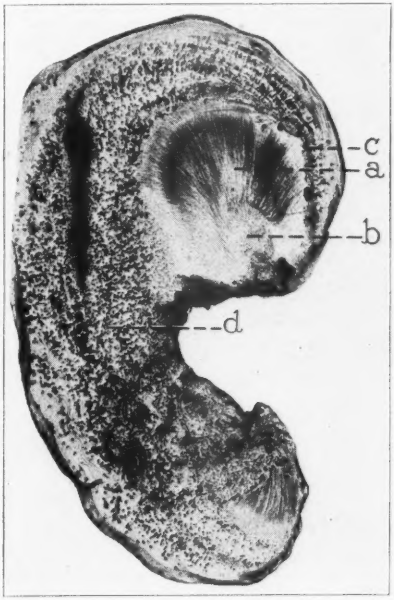

Fig. 4.—Transverse section of specimen in Figure 1, *b*. Preparation was made by grinding (unstained). *a*, dentin; *b*, root canal; *c*, line of absorbed dentin; *d*, hyperplastic cementum.

A higher power magnification of the coronal end of the specimen shown in Figure 1, *a*, is shown in Figure 3. A deposition of cementum is proximal to the line of absorbed dentin of about the has relatively few canaliculi and lacunae.

A question arises as to how it happens that such roots remain in the alveolus. Roots of permanent teeth usually remain as a result of fracture during the removal

of the teeth. The same may be true in a few cases in which deciduous roots are retained. Although the usual hazards encountered in the extraction of permanent teeth are to be considered, there is an additional condition which predisposes to fracture of deciduous molars, a condition which may also be entirely responsible for the retention of these roots. This is absorption, which often occurs in the coronal or middle third of the root and which tends to weaken it, or to separate the apical portion completely from the remainder of the tooth.

A series of roentgenograms have been selected to illustrate what actually takes place. In Figure 5*a*, it may be noted that the mesiodistal diameter of the second deciduous molar is greater than that of the permanent successor, and that the crown of the permanent tooth has extended well up between the widely bifurcated roots of the deciduous tooth. The second deciduous molar is normally larger than the first deciduous molar, and has larger roots, which are usually more widely bifurcated. It is for this reason that the crown of the permanent tooth and the roots of the deciduous tooth assume the position illustrated more frequently in the deciduous second molar, and accounts for the greater incidence of retained roots proximally to the second permanent bicuspid.

Absorption of the roots of the deciduous tooth may begin at a point well up toward the bifurcation and continue transversely through the roots while the apex is undergoing little if any absorption. Figure 5*b* shows almost complete absorption of the middle third of the roots, and the apices have resorbed far less. In Figure 5*c*, complete separation of the crown and the apical half of the distal root may be noted. When the crown is removed or exfoliated, the root remains in the alveolus between the two permanent teeth. One or both roots may be retained in this way.

The position which these roots assume in adult life varies. Figure 5*d* shows a root near the crest of the alveolar ridge; Figure 5*e*, a root between the crest and the apex of the permanent teeth, and

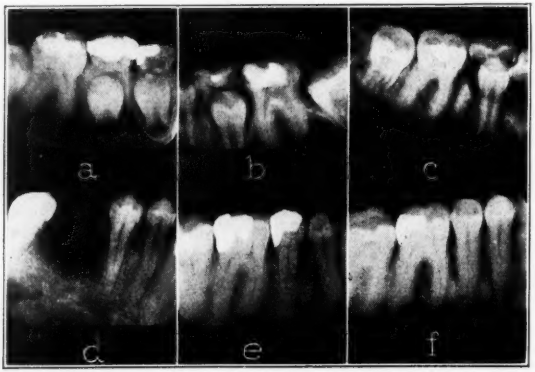

Fig. 5.—Absorption of second deciduous molar roots. The site of the deciduous roots that have been retained is shown.

Figure 5*f*, roots which are situated near the apex on the mesial and distal sides of the second bicuspid.

Deciduous roots which have been retained in the maxilla may be seen between the second bicuspids and the first molars (Fig. 6). On this aspect, which is proximal to the bicuspid, the beveled plains at which point absorption has taken place may be seen. The upper retained roots were found in the same person, which is not uncommon, as there is a tendency to bilateral occurrence.

There should be little difficulty in distinguishing deciduous roots from the so-called enamel pearls. The latter are more radiopaque and can be recognized even when superimposed on large teeth.

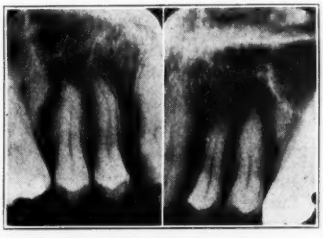

Fig. 6.—Upper second deciduous molar roots.

COMMENT

Fragments of a deciduous root covered by a thick layer of hyperplastic cementum were found in all histologic sections. In no instance was there any evidence of enamel, which disproves the often expressed opinion that these bodies are so-called tooth buds or enamel pearls. Their not infrequent presence in adults disproves the contention that tips of deciduous roots which are allowed to remain always disappear.

A high standard of service in the extraction of teeth demands postoperative as well as preoperative roentgenograms. Such service should not be limited to the extraction of teeth of adult persons, but should be given in the removal of deciduous teeth. Retained deciduous roots that are found in edentulous areas may be mistaken for tips of the roots of permanent teeth, and the operator may be wrongfully accused of having failed completely to remove the permanent teeth. In such instances, a roentgenogram obtained before removal of the tooth may prove to be an invaluable record.

A CRITICAL ANALYSIS OF PUBLIC EDUCATIONAL METHODS IN ORAL HEALTH MATTERS*

By HAROLD J. NOYES, Ph.B., D.D.S., B.S., Chicago, Ill.

PERIODS of economic depression such as we are at present experiencing have a pronounced tendency to create dissatisfaction with established concepts, irrespective of the part they play in the unfortunate times. We have ample examples of unjust and cruel attacks on public officers in both past and present periods of this sort. There is a most human desire to do anything, try any measure, in the hope that by some chance good fortune it

*Read before the Section on Dental Economics at the Midwinter Clinic of the Chicago Dental Society, Jan. 20, 1932.

may improve conditions. It is less easy to study carefully and proceed with intelligent fortitude along a path which one's better judgment indicates. When we remember that almost without exception these times of the past have resulted in a change in the political party in power, irrespective of the influence which these conditions have played in producing the situation, or of the aid they may be in recovery, we are not surprised at the character of much of the current dental economic literature.

These are times of intense nervous strain and emotional expression, uninhibited by sober and intelligent reason. There is a very real danger, moreover, that this impetuosity may initiate action which will proceed later by its own motive power along quite unexpected and perhaps undesirable channels. You will remember that the Committee on the Study of Dental Practice[1] has recently traced the development of the state and insurance dentistry as progressing in successive waves occurring in periods of economic depression. Thus, the present clamor for extensive dental advertising, in some instances, certainly, quite unrestrained, may be in a measure explained by the economic stringency. It requires that you, who bear the responsibility of being leaders in the profession, so carefully consider all steps in this direction that, when the excitement of the present emergency has passed, you will have instigated measures which will contribute only to deserved professional prestige and not to professional detriment.

The ban on advertising which grew into the dental code of ethics was not conceived in a moment of impetuous reform. It developed gradually as the profession emerged from quackery and charlatanism into what dignity it now possesses. It took form as the "tooth-puller" became a dentist; nor does its reason for existence rest unsupported by principle. It is quite true that there have been hypocrites who basked beneath its shelter, and honest practitioners who have disregarded its dictum, but when we are talking of groups and principles, we must not be distracted by generalities drawn from individual instances.

There are certain basic principles which must govern all educational measures sponsored by the profession individually or collectively. Foremost of these is the conviction that the public will benefit by the program. This does not mean that the measure cannot benefit the profession as well, but it does require that public interest be considered paramount. It is almost unnecessary to add the self-evident truth that public interest is, in the last analysis, the best interest of the profession.

Many matters should be discussed in general terms furnishing a broad understanding, omitting the confusion of details. Subjects falling under the general heads of anatomy, physiology and pathology are examples. There is often more harm than good resulting from supplying too detailed data to an audience which lacks the background necessary for understanding. Not infrequently, we have patients who offer unique suggestions regarding treatment, based on a little knowledge and insufficient comprehension. In other phases, considerable detail may be of advantage. In such subjects as preventive procedures, including care of children's teeth, diet and oral hygiene, the patient should be sufficiently well informed to avoid faddishness.

Treatment is essentially a matter for

1. Forerunners of Sickness Insurance, Committee on the Study of Dental Practice, Michigan D. Bull., 8:29 (May) 1931. Phillips, H. E.: Dentistry and Socialized Medicine, J. Minnesota D. Ass'n., 9:119 (Jan.) 1931.

the dentist, yet the patient should know enough of accepted procedure to assure his protection against unscrupulous or untrained practitioners. In prognosis also, the education may well be limited to general terms, with sufficient breadth to obviate unreasonable demands and yet allow some protection against the exorbitant claims of the unconscientious dentist. Enough of the scholastic requirements of the profession and legal qualifications should be presented to give the public an appreciation of the training and an opportunity to exercise judgment in the selection of a practitioner. Some knowledge of the value and means of procuring special training, and of mechanisms providing postgraduate study of clinical, didactic and research character, are useful in this connection. Less important, but of some interest, are matters of dental history and current events.

Certain information of so-called educational nature is contraindicated. This is particularly true of controversial matters. No item of disease, treatment, equipment or prognosis should be included in any program until it has general acceptance. The profession must lead the laity in thought, not follow it. "Scareheads" and overemphasis do more harm than good. While some patients may be frightened into a dentist's office, as a rule the human race does not need assistance in overestimating its ills. We must remember that public education is a general medium, dealing with averages and classes. Diagnosis must be left to the dentist: it is obviously impossible to train the public in this field.

Financial matters are ill-suited to public discussion. A consideration in general terms either of the basis of fees or collections carries more than a probability of creating the impression of a dollar-minded profession. Any specific mention of fee or financial arrangement is inappropriate and productive of misconception in the mind of the public as long as dentistry is practiced upon a basis of personal service of practitioner to patient. At the present time, the fee is related to the demand for the service of a particular dentist, not the value of that service; though in general there is some correlation.

The reference to special skill, methods or cures, of course, is self-evidently harmful. In general, no information should be supplied which will lead the public to expect more than can be rendered by the class of the profession to which the group addressed will apply; and, finally, nothing should be included which will lead the public to overestimate the ability of the dentist or detract from the prestige which honestly accrues to the profession.

But what, after all, have these principles to do with the practical problem which faces us today? They are of the nature of a yardstick to judge the soundness of specific educational programs which are being advocated on every hand. Most men are agreed that public education in oral health matters is beneficial to society as a whole and to the dental profession as a specialized group in the social order; but there is considerable difference of opinion as to the point where oral health education becomes dental propaganda for the express benefit of the dentist. There certainly is a vast difference in an oral health talk delivered by a conscientious practitioner before a parent-teacher association and the advertisement of a dental parlor. Where shall we draw the line, and what is our basis of judgment?

Some of you may consider that I am overapprehensive in this matter. I think not. You have heard something this afternoon of a program sponsored by some of the dentists in Little Rock, Ark.,

and many of you know, if you are not already familiar with the copy, of a newspaper series conducted by a group of Scranton dentists, and later used in Wilkes-Barre, Pa., and Indianapolis, Ind. These are perhaps the recent outstanding experiments, but pressure brought to bear on city and state societies by advertising agencies is known most intimately to members of the appropriate committees. This pressure is reflected in the adoption of a resolution presented to the House of Delegates of the American Dental Association at Memphis, approving the creation of a committee on educational publicity as a part of the Bureau of Public Relations. The Board of Trustees, Oct. 22, 1931, named the committee and authorized it "to perfect the working plans . . . and report to the Ad Interim Committee or the Board of Trustees."

Dr. Martin Dewey, President of the American Dental Association, speaking before the American Dental Trades Association, Nov. 18, 1931, outlined a five-year plan of public health education to be sponsored by the American Dental Association, the cost of which was to be covered jointly by participating component dental societies, the American Dental Trades Association and manufacturers of products whose sale is affected by the public's appreciation of dental conditions. The Chicago Dental Society was recently approached by the representative of a large newspaper with a view to the society's conducting a publicity campaign to cost approximately $25,000. The copy presented bore the stamp of approval of the Educational Publicity Committee. When the wording of the resolution and the action of the Board of Trustees is considered, this procedure may be considered somewhat premature. The Committee was empowered to perfect working plans, which, as interpreted by the resolution, were to consider carefully educational material, not to stimulate its creation. The above-mentioned incident furnishes an example of the siege which newspapers and advertising agencies will make on the many societies once the plan is underway.

It is not necessary to mention the extensive references to this problem in the pages of dental literature to convince you that we are considering a condition of immediate concern and of immense importance. It is one thing to recognize a problem and quite another to deal with it. To accomplish any practical good, we must have more than the definition of the problem and the recognition of principles pertinent to the question. When we leave the common ground that ethical public education is a desirable and beneficial thing, we immediately become confused by the maze of pathways advocated as the one sure route to the goal. One group cries "newspapers"; others, "the radio," "magazines," "health talks," "the public health department," "the school," "the dentist himself"—and we turn distracted from the bedlam of shouted suggestions. Is there any basis upon which to form judgment?

While any decision, unless based upon an experiment of long duration, carefully analyzed and controlled, is essentially a matter of judgment, nevertheless there are material and reliable means of assistance which may be enlisted. We can first apply a yardstick of the nature of the criteria previously suggested. We can review the past for similar examples, and we can analyze the public to which we make our address, and define the motive of our campaign.

If we apply this reasoning to the campaigns previously mentioned, we must feel, after carefully examining their copy, that certain of the Little Rock series ex-

ceeded the bounds of good taste, contained headings of a "scare-head" nature, included controversial subjects and presented detailed comment on matters concerning which the public lacks the scientific background necessary for understanding. Headings such as "Nature's Jewelry," "Pyorrhea and How to Prevent It," "Your Priceless Possession" and "Do You Possess Any 'Negative Teeth'?" are examples.

In the Scranton series, there are, as in that of Little Rock, a great many points which fall entirely within the principles of ethical publicity, and the series is on the whole more reserved. But there is a marked tendency to exaggeration. Is there not danger of unfavorable reaction from the better class of readers? Our statistics of dental service indicate that the majority of the clientele of members of dental societies are in the more intelligent stratum of society. There are several pieces of copy which are concerned with the financial aspect of the matter. These, aside from being somewhat difficult to reconcile with a purely educational campaign, are likely to convey the idea of an unprofessional interest in the fee. When the dentist adopts this attitude, he becomes a tradesman, and must bargain as such.

May I refer to a justification for this type of advertising which is offered so frequently that it deserves comment; namely, the reference to newspaper campaigns conducted by medical groups. Other than its influence on the reception which the public accords propaganda of this nature, it can have no weight in our judgment. The medical profession is no paragon of virtue, nor does it furnish an example to be followed blindly. The questions of method and text must be decided upon principle and shrewd judgment. The integrity of the dental profession should be equal to the task.

There is some question of the advisability of this type of newspaper advertising irrespective of the character of the copy. Let us consider these hazards for a moment. We will assume that a careful analysis of the locality, the class to which the appeal is to be addressed and the buying power of that group, has been considered. These, along with many others, are points which should be carefully covered before any funds are expended—a matter which has been given very inadequate consideration in the launching of several of the present campaigns. There are two primary factors which stand in the way of immediate satisfactory results:

1. The present limited buying power of the public which patronizes dentists who are members in good standing of local dental societies. Advertising is no miraculous wand which can be waved before the eyes of a group, hypnotizing them to buy that for which they cannot pay. During the years of inflation, we were almost inclined to this view, but, in 1930 and 1931, we have seen the drastic curtailment of many advertising programs. This was not because they were self-supporting. There are thousands of our patients who would like to avail themselves of many of the bargain securities which are on the market, even at the curtailment of their dental expenditures, but they do not. Their entire income is consumed in the bare necessities of existence. Are we not likely to create a desire for dental service which they cannot satisfy? This is not only a waste of advertising, but also a direct contribution to the demand for a mechanism providing insurance or state dentistry.

2. The fact that, when we consider the group that have not already been in the habit of procuring adequate dental serv-

ice, we find ourselves largely in the low wage class. Will a demand created here send these people into the offices of men capable of rendering good service, or will it serve to further crowd our clinics, now taxed far beyond their limits, and fill the chairs of the dental parlors which have grown dusty since the beginning of the depression?

I am not prepared to answer these questions with conviction, nor is anyone, until carefully conducted and controlled experiments with this sort of publicity have been conducted. I have written to Scranton, Pa., where one of these educational series has been carried out, and I have found far from whole-hearted approbation of the campaign. One man writes: "To my knowledge it stimulated no interest in the public at all. Not a single one of my patients even mentioned ever seeing any of the series of ads run in the Scranton papers. It has absolutely no effect at all on the payment of bills in my office." Three other representative practitioners failed to note favorable local results.

More important than the short time results of this type of propaganda are those of a somewhat later period. A plan which gives with one hand and later takes away with the other is of more danger than none. These facts are of great importance. Some of them may be considered under the following heads:

1. The previously suggested demand for service supplied by indirect taxation in place of direct expenditure. The public is all too willing to lump dentistry into one class and consider the agency which provides it as of small concern. It feels that it will obtain a standard product, be it from insurance, trade union, state or the private practitioner trained in his profession and encouraged by private endeavor to consider the best interests of his patient.

2. The unfavorable reaction in the public mind to poor dental service rendered by quack dentists benefiting from the demand created. If, as mentioned before, any considerable desire for dental service were created, much of it would be supplied by practitioners of the lowest type. There are more than 54,800 dentists in the United States, 35,455 of whom are members of the American Dental Association. This 34.94 per cent outside of the organization would certainly claim a large part of any demand created in the low wage group. Similarly, in Chicago, the 28.5 per cent of dentists outside the Chicago Dental Society would share in no small proportion in this demand, and we have reason to believe that the average performance of this class is below that of the average of the members.

3. The establishment in the mind of the public of the belief that the dentist has abandoned his professional concept and entered the field of trade fortified by the monopoly established by license and activated by trade union principles.

4. The necessity forced on the conscientious high-principled practitioner to protect himself from the unhappy results of a changed public concept of his calling. The tenure of much of the copy that we have reviewed leads to the implication that membership in the organization whose committee approved the copy is a guarantee of highest skill, judgment and professional service. Many members of the American Dental Association have, in the past, been generous of their time and unheedful of their labor in research and in development of technical procedures, and in the presentation of these benefits to the profession and through it to the public. I seriously question whether a policy of commercial advertising nature

will not force them to take steps to differentiate themselves from any group taking this action. Men who have spent years in a study, and have labored steadfastly to build professional prestige upon scientific attainment, and public confidence upon unbiased and unselfish judgment, will be forced to measures which will convince the public that they have not broken faith. Those remaining would find themselves cut off from their previous source of supply.

There have already been voices of protest. An example is the recent resolution of the Louisville District Dental Society, which "most emphatically voices its condemnation of the dissemination of such advertising or publicity material, as organized by advertising agencies and approved by the Dental Educational Publicity Committee of the American Dental Association for use in the public press." An editorial in the *Illinois Dental Journal* refers to the overtures of a newspaper to the Chicago Dental Society—"as for our largest component or any other society, it would be 'selling our birthright for a mess of pottage!' "

Space prevents a more comprehensive consideration of the contraindications for display advertising. There is, as may be seen from the few points mentioned, reason to question the immediate advantages of this type of educational endeavor, and more far-reaching dangers when its broader aspects are considered. And although the more fundamental elements or principles were disregarded — which they cannot be—there is still reason to believe that the ultimate material advantages, if ever realized, would be short lived.

While there is general agreement that public educational measures are desirable, there is considerable feeling, though obviously not universal, that group advertising in current periodicals and newspapers by the profession contains elements which are not compatible with the best interests of either the public or the profession. Some measure toward reconciling these points of view should be attempted. Can measures which are basically wholesome be instituted to further the cause? I shall not attempt any extensive exposition of this phase of the subject, but to ignore it altogether would be to commit the error of those who have waved the flag of emotional oration before the measured, steady and unheeding advance of state and insurance health service without offering practical or intelligent consideration of the problems which invite it.

If we recall the place oral health conditions held in the mind of the public fifty years ago, we must be impressed with the tremendous advances that have been made. These were accomplished by educating the dentist, and, through him, his patients, to a more comprehensive view of conditions in the mouth and the relation of these conditions to the general health of the body as a functioning unit. The departments of public health in city, state and national government have made a notable contribution. In this connection, the splendid work done by Dr. C. J. Hollister, chief of the Dental Division of the Department of Health in Pennsylvania, is an outstanding example.[2] The activities of the committees on public relations and public service of the American Dental Association and its component societies have, through constant attention to these matters throughout the United States, furnished a less spectacular contribution, but have had a positive influence on the lay and the professional mind. Enlisting the opportunities arising

2. Quar. Bull. Pennsylvania D. Soc., 2 (Jan.) 1926. Rational Dental Hygiene Program for Municipalities. (Read before the Chicago Dental Society, Feb. 4, 1931.)

through organizations of social purpose and public welfare, such as charitable bodies, parent-teacher associations, civic clubs, commercial groups and governmental agencies, they have, by means of speeches, written material, clinical service and radio broadcasts, furnished perhaps the greatest element in this change in concept. Certainly more general and less specialized factors, such as the raising of the level of public education in all fields, the inter-relation of dental and medical affairs, and the increase in the per capita wealth have also been important. Commercial advertising must be included as a factor over which the dental profession has only indirect control.

(I refer to the advertising of manufacturers of dental products, such as tooth pastes, mouth washes and the like. Irrespective of their merit, the public has been reminded of oral conditions. In 1930, fifteen of these companies spent approximately $2,956,566 on newspaper advertising; in 1931, fifteen companies spent $7,394,277 on magazine space, and six concerns $2,064,355 on radio broadcasts.)

What, then, is the reason for this sudden fear of the dental profession that the public is suffering from ignorance of dental health matters? No calling which attracts upwards of 55,000 persons can have a uniform composition. There must be many who are less favored by the public. The social studies frequently undertaken in the last fifteen years have shown that incomes below an approximate level of $1,800 a year carry a very low budget for dental expense.[3] It is most reasonable to suppose that if some mechanism were devised to increase the appreciation of the importance of dental care, the budget of all income classes would be increased, particularly those of the moderate wage group. There would inevitably result an income increase in the dental profession as a whole, and in the less adequately remunerated group in particular. The results of the progress in the conservative educational methods enumerated a moment ago bear this out; and, as far as the decrease in the average family budget accorded other items does not prohibit expenditures which would be of greater public benefit, this is justified, provided no false statements or implied reasoning is used.

We all recognize that this process has been going on slowly, but very definitely, for many years; but, with the conditions imposed by the present economic depression, the profession, along with all other classes, has felt the lack of employment and difficulty of collection. Simultaneously, there has developed a more acute realization of the harm accruing to the public through its failure to evaluate properly dental service and the semiluxuries of life. So closely did this activity follow the depression that one might almost think them related. The older, tried and less spectacular methods were inadequate to meet the present emergency. Some new mechanism, or some greater motivating power behind the older methods, was suggested, and has in some sections been tried.

Let us not fool ourselves with false motives or overconfidence in method. If we review the long period of rise in dental prestige and the demand for dental service, we shall see that it parallels rather strikingly the conservative educational programs which maintain a direct relationship to all forms of public interest,

3. U. S. Bureau of Labor: Health and Decency, 1919. Eliot, T. D.: American Standards and Planes of Living, Boston: Ginn & Co., 1931. Council of Social Agencies of Chicago: Minimum Estimate of a Self-Supporting Family. Fitch, J. A.: Contributions of Industrial Relations to Social Work, 1930, p. 553.

making the demand for the services of the dentist follow a real and unexaggerated need for them. The dental profession cannot as a part of society avoid its share in the present economic condition. With the examples that we have daily before us of the results of inflation, overexpansion and establishment of false values, it would be a sad commentary on our intelligence to commit the same blunder.

We have on the one hand an opportunity to expedite and increase the present conservative methods of dental education of the public, basing it upon actual needs and exemplifying it with beneficial service to some groups that temporarily cannot afford it; and creating in others a new realization of it by demonstration methods which even the commercial advertiser will agree are by long odds the most effective. On the other hand, the chance of fooling part of the people part of the time by overemphasis, and scaring them by partial truths into dental indulgence, which carries the danger of creating a commercial aspect of the profession, supplying, in some quarters at least, inadequate service, and adding fuel to a means of supplying this exaggerated need, appears, on superficial analysis, likely to be worse than the ill itself.

SUMMARY

We are in a time in which intelligent judgment is likely to be influenced by acute and unpleasant immediate experiences.

The determination of criteria of appraisement of public health educational methods and scientific analysis of all associated conditions are prerequisite to any innovation of method.

There are well-founded reasons to questions whether immediate financial benefit will result from display advertising, and more positive indications that the long run results may be unhappy.

The material success of the conservative policies of the past should not be veiled in the darkness of the present economic depression. It is unlikely that the members of the profession who have devoted long years to the advancement of dentistry will jeopardize their efforts by affiliation with any movement which endangers the enviable position of their calling.

While every effort should be exerted to further existing methods of established value, and initiate such new procedures as are in conformity with the immediate and remote best interests of the public, it is extremely hazardous to depart from this procedure upon any evidence thus far offered.

These matters are worthy of very sober thought.

It is a strange fact that, in a society composed of scientifically minded men, there is a pronounced reticence about spending either time or money in the conduct of careful preliminary study of problems on which they are called to form judgment and act. This is true of scientific as well as of economic matters. I am in no way minimizing the value of public education, yet I have no hesitancy in saying to you and to all other dentists who represent the better elements of our profession that, on your judgment and your action, rests the import of an important chapter in the history of dentistry.

30 North Michigan Avenue.

THE CASE FOR EDUCATIONAL PUBLICITY

By JOHN OPPIE McCALL, D.D.S., F.A.A.P., F.A.C.D., New York City

DURING the past year and a half, the dental profession in this country has been much agitated over the question of educational publicity. There has been much confusion and misunderstanding of the facts relating to this subject as far as they refer to the acts of the American Dental Association and certain of its committees. There has also been considerable uncertainty as to the propriety of the dental profession's going before the public with educational publicity material. This article is an attempt to clarify the former situation and to demonstrate the fitness and the need of educational publicity as a health measure.

Regarding the actions of the American Dental Association, the following are the facts: During the year 1930-1931, a group of dentists in Little Rock, Ark., all members of the American Dental Association, believing that educational publicity would be beneficial to the public as well as to the profession, organized an association and engaged a publicity director to devise a means of acquainting the public with the relationship of dental disease to general health and to disseminate needful knowledge about dental health. This publicity director prepared a series of releases for insertion in the daily press of that city, the material appearing over a period of about eighteen months preceding the time of the meeting of the American Dental Association at Memphis.

For some time preceding this meeting, and as a result of the Little Rock campaign, the chairman of the Judicial Council of the American Dental Association had been receiving numerous letters from the officers of dental societies in various parts of the country asking whether the Judicial Council regarded it as ethical for dental societies to secure the publication of such material. One of the important points raised was that regarding the ethics of using such material in display space, paid for at advertising rates. The Judicial Council, appreciating the fact that a very broad question of policy was thus raised, deferred sending a decision and advised the societies making the inquiries to enter into no contracts for the preparation and publication of material of this type, pending action of the American Dental Association of Memphis.

At the Memphis meeting, the Judicial Council presented a report to the Board of Trustees, from which the following is quoted:

> The major problem brought to the attention of the Council was concerned with the so-called group advertising. This matter was the subject of a great amount of correspondence from all sections of the country. Starting in Little Rock, Arkansas, it seems to be gaining headway because of the fact that it is meeting with great favor. Your chairman has gone into this question rather thoroughly and submits the following information:
>
> There is more or less general belief that the so-called Little Rock type of advertising was originally proposed and sponsored by an advertising agency. We are reliably informed that such is not the case. It appears that a group of dentists (ethical men) in Little Rock, Ark., conceived the idea of an educational

campaign through the public papers, and in furtherance of this idea sought the advice and counsel of a Mr. Leo P. Bott, Jr., of the Bott Advertising Agency, and, as the result, copy was prepared and published. The interested group paid for the copy and its publication by apportioning the costs among the members on a monthly basis. The chairman has interviewed Mr. Bott, and has been impressed with his earnestness and his desire to maintain this advertising on a high plane. So far as your chairman can see, there is little to criticize in the copy itself. The question to be decided is rather the principle of this type of publicity.

In replies to inquiries concerning this subject, the suggestion has been made that the policies concerning group advertising will probably be determined by an authorized body in the American Dental Association. It would appear further, from the chairman's information, that groups in widely scattered sections of the country are going ahead and conducting publicity campaigns, using the Bott copy. Other advertising agencies are entering the field and proposing to use copy of their own, some of which we are informed may not be on a very high plane.

It is because of the growth of this idea that it will be necessary for the American Dental Association to take some action whereby it may exercise some control over its own members in this type of activity.

The Trustees, after full consideration of this report, approved the principle involved in this plan, and, subsequently, acting on the recommendations of the Judicial Council quoted above, the Board of Trustees made provision for the creation of a committee on educational publicity.

Taking cognizance of the action of the Board of Trustees in this matter, the House of Delegates passed the following resolutions:

Dr. Casto: The following standing resolutions were presented yesterday, and are to be acted on today. The first is:

WHEREAS, certain cities and communities have undertaken campaigns of educating the public on the subject of dental health; and

WHEREAS, the necessity of a careful consideration of this educational material by the American Dental Association is apparent; and

WHEREAS, the Board of Trustees has recognized the above mentioned conditions; and

WHEREAS, the Board of Trustees has recommended that a committee on educational publicity be created as a part of the Bureau of Public Relations; be it therefore

Resolved, that the House of Delegates approve the creation of a committee on educational publicity as a part of the Bureau of Public Relations; and be it further

Resolved, that the Board of Trustees be given authority to draft rules and regulations for the conduct and control of the activities of said committee.

I move the adoption of this standing resolution.

The motion was seconded by Dr. Finley and carried.

In conformity with the foregoing resolutions the Board of Trustees then took the following action:

Dr. Bruening: I move that the following constitute the Committee on Publicity: Alfred Walker, New York City, chairman, Frederick H. Lum, Jr., and John T. Hanks, the President to serve ex officio; and that this committee be authorized to perfect the working plans of such committee, and report to the Ad Interim Committee or the Board of Trustees.

The motion was seconded by Dr. Winter and carried.

At the Ad Interim meeting of the Board of Trustees in Chicago, Jan. 20, 1932, a committee was appointed to draft notes regarding the control and conduct of educational publicity. The following report was presented:

In conformity with the action taken by the House of Delegates and the Board of Trustees, the Educational Publicity Committee presents the following working plans:

1. Educational Messages. The committee adopts the principle of the use of educational messages according to the plan suggested by the Judicial Council at the Memphis meeting. The committee shall pass upon copy submitted by advertising agencies, which copy may then be used by local dental societies.

The committee contemplates the preparation of educational messages which shall be

released directly to local societies for their use.

The committee contemplates the employment of a publicity director who shall supervise publicity matter as relates to the American Dental Association. Said publicity director shall prepare copy which shall be passed upon and approved by the Educational Publicity Committee before being sent to the various newspapers or other news disseminating mediums.

The committee advises the use of the radio by the American Dental Association and by State and Local Societies for the dissemination of oral, dental and general health topics, the subject matter to be approved by the proper committee of the American Dental Association.

2. Finances. The committee shall interest various bodies and organizations as to the importance of dental health publicity for the purpose of obtaining donations from said bodies or organizations. Such money shall be turned over to the Treasurer of the American Dental Association, and spent for the expense of said committee and to pay for other activities of the Educational Publicity Committee. The Treasurer of the American Dental Association shall keep an accurate record of the money received and expended.

The committee shall make a report of its activities to the Board of Trustees at each annual meeting or whenever called for by the Board of Trustees.

(Signed) FREDERICK H. LUM, JR.
ALFRED WALKER.

This report was adopted on motion of Dr. Foster, seconded by Dr. Dittmar.

It will be noted that the Board of Trustees and the House of Delegates were made fully cognizant of the fact that educational publicity material of a display type had appeared in certain newspapers, being paid for at advertising rates by an ethical dental society, and that there was in contemplation an extension of this program by constituent societies of the American Dental Association. The resolutions presented by Dr. Casto, quoted above, indicate a full appreciation of the significance of such a campaign. It will also be noted that the Board of Trustees, Jan. 20, 1932, adopted the report presented to it, in which the plans of the Educational Publicity Committee and the method of financing the proposed campaign were outlined.

The foregoing constitutes a record of the facts relating to the question of educational publicity as far as official acts of the American Dental Association are concerned. It now seems well to discuss the principles involved in this question as they relate to the use of publicity material in the presentation of which newspaper or magazine space is paid for. Throughout this discussion, it should be clearly kept in mind: first, that the American Dental Association has not sponsored or advocated the use of such educational publicity material; second, that the Committee on Educational Publicity has not sponsored or recommended the use of display publicity. The committee has, however, in conformity with instructions issued to it, edited and controlled material submitted to it which was intended to be offered to such dental societies as might wish to use it. On the other hand, the committee is, also in conformity with instructions to it, actively engaged in preparing news articles and editorials. These have been accepted by newspapers throughout the land without such space being paid for.

It will be seen then that campaigns to use paid display space may be undertaken by component societies of the American Dental Association at their discretion and that the material used in such campaigns must be submitted to the censorship exercised by the Committee on Educational Publicity of the American Dental Association.

At the same time, the committee, in pursuit of its duties "may interest various bodies and organizations as to the importance of dental health publicity for the purpose of obtaining donations from

said bodies or organizations." The committee has adopted rules under which no conditions may be imposed by the donors of such money, which is to be used in such manner as the committee shall decide. It may be well to call attention to the fact that the medical profession and philanthropic organizations have by custom enunciated the principle that money from commercial organizations as well as individuals may properly be accepted under such conditions.

With the foregoing explanations, it seems clear that the one and only point remaining as subject for debate is the question of the propriety and desirability of presenting to the public educational material regarding health as this relates to dental problems. On this point, it is very clear that even those who object most strenuously to the so-called advertising campaign are, in the same breath, advocating the presentation of educational material to the public, their only stipulation being that the space used for presenting this material is not to be paid for. If their objection to paid educational publicity is based on the fact, as sometimes stated, that it is bound to create a demand for dental service from which the dentist will profit, it may be pointed out that the publication of educational material not paid for will do the same thing. It seems strange that these conscientious objectors are so willing to get something for nothing.

As a matter of sober fact, it is impossible that an educational campaign regarding the health aspects of dental conditions should produce practical results in a community without the active intervention of dentistry in improving the dental condition of that community, regardless of how such a movement is conceived and carried on. The control of dental disease is necessarily vested in large part in the hands of the dental profession. People cannot carry out for themselves measures for the relief of dental disease. The same situation holds in large part regarding the educational publicity efforts of the medical profession, of which we seem to hear no criticism.

This being the case, the dental profession should have no qualms in presenting itself to the public as a health agency, but should take the attitude that it is offering to the public something from which the public will benefit far more than will the profession.

The dental profession may, as a matter of fact, well hold up its head in this matter because of the fact that it has a public record of endeavoring to find effective means for the prevention of dental disease. Imperfect as is available knowledge regarding prevention, such knowledge is being placed in the hands of the public through all the educational publicity messages, whether paid for or not. Certainly, as additional knowledge is acquired, it will be presented to the public; and to the extent that discovered means of prevention are effective and to the extent that they are used, the public will benefit and the profession will proportionately suffer.

The objection has been made that, until dentistry furnishes free dental service for those who cannot pay, paid educational publicity is nothing more nor less than advertising.

As it happens, with the recognition by hospitals that dental service is a necessary part of health service, and with the establishment of hospital dental staffs, it is now possible for even the indigent to have such extractions and oral surgical operations as are needed, from the health standpoint, performed without cost. In some communities, full denture service can be had through the social service societies or departments of hospitals, also

without cost. This service should be extended. Yet even now we see that educational publicity is not creating a demand for something which the object of that publicity cannot command in at least its ultimate essentials.

On the other hand, there are a large number of people who can afford to pay something for dental service, who are paying for luxuries such as automobiles, radios and cosmetics, and neglecting their teeth. These people fail to realize the health aspects of dental disease. Also they are apt to be on an intelligence level that makes them likely to overlook scientific articles on health in the press. They must be appealed to in regard to their health in much the same way as they are being appealed to by the merchandiser of the above-mentioned luxuries. This means the use of display space and the necessity of paying for that space.

Weighing all of the points enumerated, it seems that the case of educational publicity should be decided in favor of this activity, and that the dental profession should take its place alongside the medical profession in the effort to stamp out disease by educational means, each profession utilizing the means to this end which have been found most effective in modern society.

A CASE OF PSEUDO-ALVEOLAR ULTRAPROGNATHISM

By M. F. ASHLEY-MONTAGU, New York City

THE skull described in this paper exhibits, among some other interesting features not directly related, a condition which I shall describe as pseudo-alveolar ultraprognathism.

The cadavar to which this skull belonged, that of an American negro of mixed origin, aged about 45, was received by the Department of Anatomy of Bellevue Hospital Medical College for the purposes of the usual routine dissection. The maximum length of the skull is 182 mm. and the maximum breadth, 132 mm. As to the other cranial proportions, it is only necessary to say that they are quite normally symmetrical in relation to the length and breadth, with the exception of the prognathism to be described and the lowness of the vault of the skull on the left side as compared with that on the right.

The mandible is remarkable for the rather short anteroposterior diameter of its rami, which, in their greater extent, measure only some 30 mm., which is about 6 mm. less than the average for the negro of mixed blood. It would seem that some years before death, the posterior teeth and the alveoli of the mandible were badly abscessed, the second bicuspid and all the molars on the right side, and all the bicuspids and molars on the left side having been removed. The remainder of the teeth are present and are in perfect condition. As a result of this loss of teeth, the bone on both sides of the mandible has been greatly absorbed. On the left side, the mylohyoid ridge forms an almost plane surface with the oblique line on the lateral surface of the mandible. The height from base to alveolus is only 16 mm., whereas the infra-

dental-gnathic height is 42 mm. On the right side, the body is about 5 mm. higher, that is, 21 mm. in height, the mylohyoid ridge being about 5 mm. lower than the superior alveolar surface. It seems superfluous to add that the great absorption of bone in the posterior region of the mandible is clearly due to the loss of the structures, namely, the teeth, which they must normally support. It is interesting to observe nonetheless to what a marked extent the ramus of the mandible is affected by the loss of the posterior teeth, but this is no more than we would expect, since the angular portion of the ramus is intimately associated in development with the posterior part of the alveolar process giving support to the distal molars.

In the maxilla, the first, second and third molars have been lost on the right side only, the remainder of the teeth being present and in good condition. On the lateral surface of the alveolus of the second molar, there is an appreciable abscessed exostosis, similar to that which occurs on the site of the two left bicuspids of the mandible. There has been some unitary movement posteriorly from the two upper bicuspids on the right side, for there is a diastema of about 6 mm. between the first bicuspid and the cuspid. The diastema on the left side is only 3 mm. wide. The ultraprognathism is exhibited in the extreme obliquity of the subnasal maxilla, which forms an angle of 58 degrees in relation to the Frankfurt plane. This is remarkable in an American negro of mixed origin in that alveolar prognathism is a recessive character and the mixed negro skull is generally no more prognathic than the white. An alveolar or subnasal prognathism of 58 degrees is within the range of variation for the unmixed American negro skull, although the frequency of such a marked degree of prognathism is very low. The average American negro exhibits an alveolar prognathism of about 71 degrees. The average for the white is about 82 degrees, and the range of variation for the whole human species lies between 49 and 100 degrees.[1] The important point about the present skull is that the nasal profile angle, that is, the angle formed in relation to the Frankfurt horizontal by the nasion-subnasal line, is 84 degrees, about 4 degrees less than the average for the pure white. With such a low facial prognathism, we would not normally expect to find such a high alveolar prognathism, a difference in this case

Right lateral view of skull displaying ultraprognathism. The upper bicuspids have drifted; there is a posterior maxillary exostosis and an abnormal development of the styloid process.

of 26 degrees. In the American negro, the nasal prognathism is about 81 degrees and the alveolar, 71 degrees, a difference of 10 degrees. In the Australian aborigine, the nasal prognathism is 80 degrees and the alveolar, 66 degrees, a difference of 14 degrees. It will be observed, then, from these figures, that the

1. Martin, R.: Lehrb. d. anthropol., 2:911-917, 1928.

difference of 26 degrees between the nasal and alveolar prognathism is, in the present example, much too marked to be accounted for by a reference to the normal processes of development, and, indeed, an examination of the skull at once reveals the nature of the simple mechanism which has been responsible for the production of the ultraprognathism.

It should here be explained that the condition in this skull is being described as an example of pseudo-ultraprognathism as distinct from normal ultraprognathism, not because of the extreme degree of prognathism which it displays, for human craniums exhibiting an alveolar prognathism as high as 49 degrees have been described[2]; nor yet because of the great difference in the relation between the nasal and alveolar prognathism; for among the northeast African negroes, we find as low a nasal prognathism as 83 degrees associated with an alveolar prognathism as high as 62 degrees (even so, this is still 5 degrees lower than the difference in the present skull), but for the reason that it reveals a condition which is due to purely accidental occurrences that, in this instance, have given rise to an acquired ultraprognathism which is not an inherent developmental character of the skull itself, and which is carefully to be distinguished from normal ultraprognathism. This skull may incidentally serve as an illustration of the important part that the teeth play in determining the form of the jaws.

In the maxilla, the posterior teeth, where present, have descended almost to the full length of their crowns below the level of the anterior teeth. This, of course, is due to the fact that these teeth encountered no antagonists below, the greatest amount of stress being therefore put, without any means of resisting it, on the anterior teeth and alveoli, with a resultant anterior thrust of the maxilla and the mandible. The plane of the teeth follows the same inclination as the maxilla and the mandible. In the mandible, the teeth stand vertically upright and the anterior surfaces of the incisors project about 2 mm. beyond the mental protuberance when the mandible is resting upon its base upon a plane surface. The external angle formed by the articulation of the upper with the lower teeth is 115 degrees. In occlusion, the anterior teeth display an edge-to-edge bite.

The height of the maxilla from the prosthion to the subnasale is 25 mm. It exhibits two exceptionally deep canine fossae.

The palate is somewhat flat anteriorly, that is to say there is no distinct demarcation between palate and alveolar process, the one rising into the other imperceptibly and without any arching. The total length of the palate is 63 mm., and the breadth, 64 mm. The breadth between the cuspids is 44 mm.

The styloid processes in this skull are unusually strongly developed. The left is 21 mm. in length and 5 mm. in diameter, the right, 29 mm. in length and 5 mm. in diameter. Apart from the robust character of these processes, an interesting feature is to be found in the wide splaying of the tips, which exhibit clear evidence of the presence of cartilage. Since the basilar and sagittal and parts of the coronal and lambdoidal sutures are closed, it is somewhat surprising to find this abnormal continuance of growth in cartilage of the styloid processes.

SUMMARY

The mixed negro skull described exhibits a nasal prognathism of 84 degrees and an alveolar prognathism of 58 degrees.

2. Footnote 1, p. 914.

Alveolar prognathism was produced by the loss of the posterior teeth, which caused the greatest stress to fall on the anterior teeth, and thus everted the alveoli, producing the condition which has here been termed pseudo-alveolar ultraprognathism.

An abnormal development of the styloid process was associated with this condition.

CONTROL OF DENTAL CARIES AND SOME ASSOCIATED DEGENERATIVE PROCESSES THROUGH REINFORCEMENT OF THE DIET WITH SPECIAL ACTIVATORS*

By WESTON A. PRICE, D.D.S., M.S., F.A.C.D., Cleveland, Ohio

DENTAL caries is generally considered to be the most nearly universal disease to which man is subject. It is considered by many to be the most serious single disease in its direct and indirect effects. Careful, critical observation in many communities has indicated that it is on the increase and that this was true even before the present world-wide industrial depression. A century of intensive study has not revealed in full its etiology nor considerably reduced its severity. Like many other affections, dental caries has been looked on in the past almost entirely as a unit problem. Until very recently, it has not been seriously associated with nutrition. It has been associated primarily for the last three decades with the acid-producing bacteria, as suggested by W. D. Miller.

I shall include in the consideration of a dietary food products not only by title but also by their fundamental nutritional factors. The term "control" I shall understand to apply both to prevention and to the checking of the progress of caries when established.

The irregularity in the appearance and incidence of dental caries in various individuals brings to consideration many possible contributing forces. The fact that dental caries may be relatively infrequent or of mild degree in persons living in a given community and at the same time very severe in persons living in another community introduces for consideration not only the physical environments of the two groups, including climate, but also individual factors such as physical and mental stress, the care of the mouth and the quantity and type of food eaten.

Until we can have a common understanding of the many contributing conditions, confusion and conflict in interpretation will be inevitable.

An illustration of the fundamental need for a much broader concept and understanding of the conditions with which we are dealing is provided in the apparent interpretation of the data available with regard to increased susceptibility to dental caries under the physical stress of pregnancy.

A study of the history of peoples as revealed by the idioms of their language has disclosed that practically every race with a language has a phrase equivalent to a "tooth for every child," notwithstanding these languages may have had

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Third Annual Session of the American Dental Association, Memphis, Tenn., Oct. 20, 1931.

their origin in the dim and distant past.

This can be accounted for only on the basis of the recognition of a clinical fact. It is probable that clinicians from different countries of the world would give quite different reports of their observations with regard to the correctness of this statement as applied to the people of their communities. The majority doubtless would corroborate this observation. The difficulty in corroboration would depend on facts which were fundamentally correct, but only apparently comparable, for both might have a controlling influence in diet. In the light of the data which I shall present, foods of the same name but produced in different sections may have very different values from the standpoint of their adequacy to provide complete nutrition.

My researches of the past decade have been directed largely toward establishing data, both clinical and laboratory, that would throw light on both the possibility of accomplishing control of dental caries and pyorrhea and the practical means for so doing. My several research reports made during this period, and some in process of publication, present data apparently indicating that dental caries can be controlled under the specified conditions presented. That we have perhaps reached the time when it is possible to control and prevent dental caries is important for the following reasons: (1) it is the most nearly universal disease and in nearly all civilized countries is increasing in severity notwithstanding prophylactic procedures; (2) no other area of the body provides a comparable portal of entry for organisms that become pathogenic and produce serious degenerative processes by metastatic invasion of other organs and tissues, and (3) dental caries in the light of our newer knowledge is even more important because of its significance as one of many symptoms of nutritional imbalance and organ and tissue degeneration than the injury of the teeth, important and serious as that injury is.

As an approach to the discussion of this problem in the light of our newer knowledge, I shall first present clinical data and secondly discuss the nature of the nutritional factors involved and requirements of the body for mineral nutrition.

There are few clinical conditions associated with so rapid and persistent a type of dental caries as is found in xerostomia. In 1923, I published results of successful treatment of this disease with cod liver oil.[1] It is of interest that the patient referred to as having been under treatment then for a year has had a marked and progressive improvement in all her symptoms to date. This is particularly significant since a large majority of the cases reported up to that time had not responded to treatment, but had had progressive involvement, the dryness of the mouth extending to the throat, air passages, eyes and other mucous membrances. In practically all cases, severe arthritic involvement developed. This patient, at the time she came in, could scarcely walk or use her hands owing to a severe arthritis. The treatment has been continuous during these years and she has been practically free from arthritis for several years. Mineral metabolism disturbance in arthritis, with and without dental caries, will be discussed later.

The product that was first given this patient was ordinary raw cod liver oil and a parathyroid gland tissue prepara-

1. Price, W. A.: Dental Infection and Degenerative Diseases, Vol. 1, Cleveland: Penton Publishing Co., 1923.

tion. The latter was early discontinued, for it was found that activation of the cod liver oil by exposure to the sunshine for a few minutes produced quite favorable results. This treatment was later improved, as will be related.

Among the patients under treatment during 1923 and 1924 was a boy who, at the age of 14, had seventeen cavities, some of which nearly entered the pulp chamber. He was put under treatment with the activated cod liver oil. The roentgenographic appearance of the teeth as they appeared in 1924 and 1925, a year intervening, is shown in Figure 1. During this year, no new cavities had formed and, in addition, as shown in the illustrations, there was a marked improvement in the density of the teeth. This was reported in detail in April, 1926.[2] It seemed apparent in this case that something was provided by the cod liver oil that reduced the dental caries.

In a series of eighty-seven patients carried through the two years 1928 and 1929, a critical study was made to compare the number of cavities in two groups, one receiving additional vitamins and the other not receiving them, with the result that forty-nine patients receiving no treatment and using their regular diet had an average of 4.85 cavities in 1928 and an average of 4.73 cavities in 1929. The most severe cases were placed in another group on special treatment with a mixture containing a concentrate of vitamins from a high vitamin butter, which I shall describe later, and a very high vitamin cod liver oil in small doses of from 0.5 to 2 gm. of the mixture. This group before treatment in 1928 had an average per person of 8.02 cavities. In 1929, after being on the treatment for a year, they had an average per person of 1.44 cavities.

A group of fifty-six who were examined between March 25 and April 7, 1930, a two-weeks' period, was divided into subgroups and studied. These subgroups consisted of those persons from 12 to 18 years, the boarding school group and the pregnancy group. These studies revealed that those in each group that were receiving treatment showed marked improvement. In practically all cases, they had been put on the treatment because they showed very severe dental caries. For example, in a general group of forty-four without treatment, the average number of cavities per person was 2.9; whereas, the twelve having treatment had an average of 0.25 cavities per person. In the teen-age group, the nine without treatment had an average of 5.5 cavities per person, and the six having treatment had no cavities. All of these cases were examined in or about September, 1929, the study including roentgenograms, which are used routinely in all these studies. In the boys and girls from boarding schools, the four without treatment had an average of 8.5 cavities per person which developed in practically a six-months' period. The four receiving treatment were all without dental caries. Of the two pregnancy cases examined, the one without treatment showed nine cavities, the one receiving treatment, one cavity.[3]

2. Price, W. A.: Calcium Metabolism Studies, Am. J. Dis. Child., 33:78-95 (Jan.) 1927.

3. Price, W. A.: Some Contributing Factors to Degenerative Diseases, with Special Consideration of Rôle of Dental Focal Infections and Seasonal Tides in Defensive Vitamins, D. Cosmos, 72:1049; 1119 (Oct.) (Nov.) 1930.

4. Price, W. A.: New Light on Control of Dental Caries and Degenerative Diseases, J.A.D.A., 18:1189-1219 (July) 1931.

In July, 1930,[4] I reported progress, presenting data on about 200 persons, approximately 100 in each group, one receiving and the other going without additional vitamins. The number of cavities per person in the group not receiving the capsules was for all ages ten times that which occurred in the group receiving the capsules. For the teen-age group, the difference was very much greater. For example, in the twenty persons not receiving additional vitamins in capsule form, the total number of cavities was 143, and in the group of twenty receiving the additional vitamins, there were three cavities in the entire group, which had developed in a period of less than one year. Practically all of these persons had been studied critically with roentgenograms of the teeth, bitewings or full dental films. The data developed in the group from 50 to 60 years old were particularly interesting in view of the fact that in the group from 20 to 50 years of age not receiving vitamins in capsule form, the curve for caries had been progressively downward, but, in the next decade, the number of cavities per person doubled, increasing from an average of one cavity per individual to two cavities per person; whereas, in the group receiving additional vitamins, there were no cavities in either the 40 to 50 age group or the 50 to 60 age group.

Light is provided by the following case: A young girl came to Cleveland from Ontario at the age of 16, at which time she had a remarkable set of teeth, never having had a cavity develop in any teeth. She had been complimented by her dentist on having a practically perfect set of teeth. She attended a university in Ohio and during the first year was reported to have developed twenty-two cavities. These were filled by a skilful dentist. The following year, she was brought to me for study of the possible cause of the continued active progress of dental caries, at which time, namely, July, 1930, she had twelve cavities, which had apparently developed since the filling of the twenty-two cavities the year previous. These cavities were filled and she was placed on additional vitamins. She has been examined

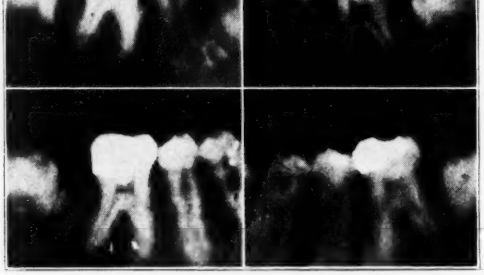

Fig. 1.—Severe dental caries with seventeen open cavities in a boy of 14 years, completely checked by treatment. Reduction in the size of the pulp chambers in one year, especially in the bicuspids, is evident. Above, films taken Dec. 5, 1924; below, films taken Dec. 24, 1925.

frequently during the past eighteen months, and not a single new cavity has been found. It must be noted first that these teeth apparently were of good structure and, under her home environment and dietary program she was completely free from dental caries. In her new environment and under a new dietary program, she developed more than thirty cavities in two years, and in that same environment and largely under the same dietary program, except with additional vitamins, the dental caries was apparently completely controlled. It is, of course, important that advice was given in regard to the selection of foods, although much opportunity for improvement in a dietary schedule may not be offered in a boarding house where, of necessity, the rate of charge is moderate and the selection and variety of food somewhat limited.

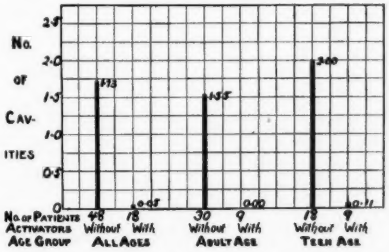

Fig. 2.—Control of dental caries. Of sixty-six patients examined during one month, a comparison of those receiving special activators with those not receiving them showed a ratio of cavity development of about 1:30.

The program of reexamination is continuous. The results after a typical month will be given. During the last Christmas and New Year holiday period, several of the boys and girls attending colleges and boarding schools returned to their homes and they, with local students, came in for examination. The period included in this particular study of caries was from Dec. 16, 1930, to Jan. 16, 1931, and included persons of all ages. These cases were carefully studied by direct examination, with the aid of roentgenograms, for the presence of dental caries (Fig. 2). This group included sixty-six persons, forty-eight of whom had not been receiving activators as provided by me in capsule form, and this group had eighty-three cavities, or an average of 1.73 cavities per person; eighteen had been receiving the special activators to prevent dental caries as provided by me in capsule form, and, in this group, only one cavity was found,

Fig. 3.—Reduction in size of pulp chambers under treatment. This patient when first seen had thirty-eight open cavities of active caries. The changes in tooth structure in three months are evident.

or an average of 0.055 cavities per person, a ratio of 31:1. In the entire group, twenty-seven were of teen age, and there were thirty-seven cavities in the teeth of these twenty-seven persons. Of these, eighteen had not been receiving special activators, and these eighteen had thirty-six cavities, or an average of two cavities per person. Nine of this group had been receiving special activators and, in the entire nine, only one cavity was

found, or an average of 0.11 cavity per person. There were thirty-nine adults, who had a total of forty-six cavities, or an average of 1.24 cavities per person. In this group, there were thirty who had not been receiving additional vitamins, and they had forty-six cavities, or 1.35 cavities each. Nine had been receiving the special activators in capsule form and not one cavity was found in any one of the nine.

It will be kept in mind that practically all of those receiving capsules had been examined in the early or late summer, mostly both, by the same careful procedure, and these persons were placed on the special vitamin capsules because of previous marked susceptibility. Several were patients who had been placed in my care at the request of their dentists because of the excessive amount of dental caries that was developing. The results here obtained are in spite of that previous marked evidence of susceptibility to dental caries. It will also be kept in mind that, of the adults examined, about two-thirds had had their mouths repaired within the last six or twelve months. It will be seen from these several special groups of studies that the same general results are being produced with an average ratio for the several groups of studies of about 30:1. This group contains some especially instructive cases which were referred because of the aggravated nature of the susceptibility to caries.

One young woman was transferred to me at the request of her dentist, who stated that he had had appointments with her monthly and could not keep up with the progress of the dental caries and did not wish to continue to have the responsibility. This patient presented thirty-two cavities, which were repaired, and she was then placed on the special vitamin capsules. During the next three years, she had two or three small cavities a year while taking the capsules. She stopped taking them when she went away to college, and, in the following six months, developed seven cavities.

A young man was sent from a distant city with the report that his dentist could not keep up with the progress of the caries with an appointment a month. He presented thirty-six cavities, which did not include one molar tooth that had so many cavities and so serious a pulp involvement that it had to be sacrificed. The first three months after he began to take the vitamin capsules, he had two small carious areas, which may or may not have been new. They were very slight and at the gingival margin of an old alloy filling and in a position where they were not disclosed by the roentgen rays. Probably, they had not been considered important because they were so slight in comparison with the many deep

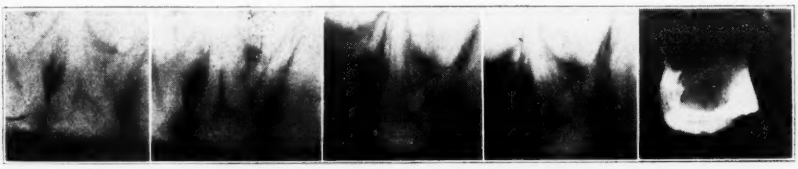

Fig. 4.—Caries inactive under treatment: Left to right: Nov. 16, 1929; Feb. 18, 1930; May 22, 1930; Sept. 13, 1930; September, 1931 (when shed).

cavities that the patient previously had. An important phase in this case is illustrated in Figure 3*A* which shows the change in the size of the pulp chamber in that short time. The lower left second molar had a carious cavity that apparently had reached the pulp chamber. As much of the caries was removed as was considered safe if exposure was to be avoided. The remaining caries was sterilized and a temporary filling placed with the hope that the pulp would build a defensive wall and thus protect itself. It will be seen that this has actually taken place and that the pulp chamber is actually smaller than it previously was. In the following year, only a few small areas developed under treatment. A similar rapid reduction in the size of the pulp chamber, which is associated with successful treatment for the control of dental caries in a girl 12 years of age, is shown in Figure 3*B*. This reduction in the size of the pulp chamber of a molar during treatment is also shown in Figure 1. In a number of persons whom I can watch carefully, I have purposely left cavities without filling to ascertain whether caries would cease to be active. I have several of these that have gone for an extended period with no recurrence of activity. A typical one is shown in Figure 4*a*, *b* and *c*.

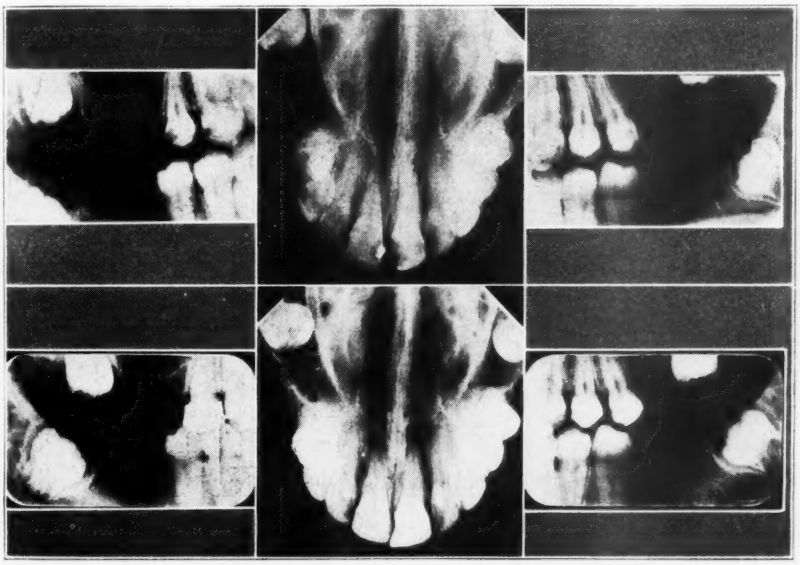

Fig. 5.—Rampant dental caries controlled by treatment. Above: Eight molars and bicuspid lost and many open cavities present at age of 14. Below: No new cavities or extension of unfilled decalcified; age 15. This patient, a girl, was broken in health from faulty nutrition, which was also the cause of the excessive tooth loss from dental caries. Dental and general health have been restored.

This is a deciduous tooth in the mouth of a boy, 11 years of age at the

time the first picture was taken, namely, Nov. 16, 1929. The succeeding views, taken Feb. 18, 1930, May 22, 1930, and Sept. 13, 1930, show no increase in the depth of the caries cavity. The adjoining bicuspid was shed and the frail margins of this cavity were broken down. This tooth was preserved by the patient when it was exfoliated, in accordance with my request. The resorptive organ had removed much of the dentin from the crown and sufficient of the enamel

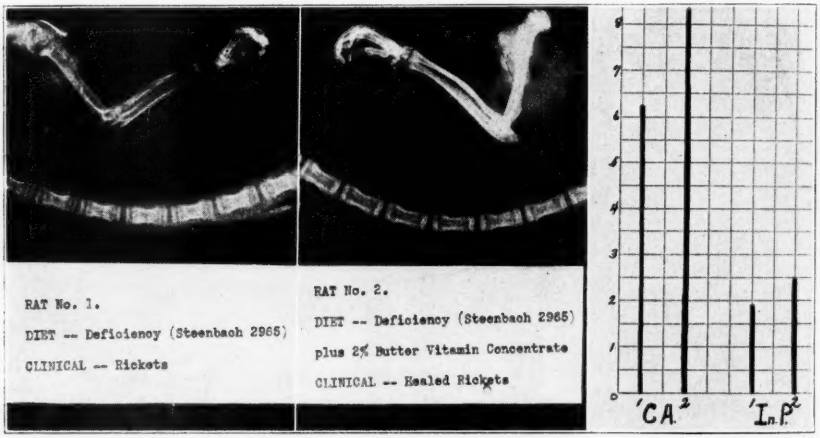

Fig. 6.—Treatment of rickets in rats by adding to deficient diet 2 per cent of butter vitamin concentrate. The addition of the concentrate has prevented rickets in rat 2 which is pronounced in rat 1. There is also a marked change in the level of calcium and inorganic phosphorus of the blood serum.

to make a perforation in the occlusal surface. The surface of the cavity is hard and almost glassy in smoothness. The decalcified carious dentin had been removed by attrition. The remaining dentin had greatly increased in density by precipitation of minerals into the tooth structure, probably chiefly from the saliva. Figure 4*c* is a roentgenogram of this exfoliated tooth.

In connection with these studies of dental caries and its control, a distressing feature is the finding of many young men and women who are seriously breaking in health simultaneously with the development of the dental caries. These are generally associated as symptoms or effects of a common cause rather than being regarded as having the relation of cause and effect.

Girls, who in their late teens are suffering from active dental caries, may enter the responsibilities of womanhood with physical handicaps which will often be the beginning of complications and low vital capacity. These girls frequently not only suffer from depressing disorders but also develop ovarian cysts which require operative procedure in later years. In their normal lives as mothers, they are handicapped because of physical deficiency during the growth period. This condition is probably directly related to the absence of certain vitamins or activators as is also their dental caries.

A young man was brought to me from

another state in June, 1931, with thirty-eight open cavities, several enlarged glands in his neck, acute rheumatism and a heart lesion. He was 16 years of age. His mouth was put in good order and he was placed on the special vitamin capsules. When he returned three months later, there had been no extension of dental caries, but instead a marked improvement in the structure of the teeth. He returned with a buoyant physical expression and reported that he was now more rested with six hours' sleep than formerly with ten hours'. He said he was able to carry on his work without tiring. The heart condition was greatly improved. The swelling of the glands had disappeared, as had also his rheumatism.

The dental caries was primarily a symptom of nutritional deficiency, in that he could not maintain a proper health level on the vitamin intake and dietary schedule to which he was accustomed.

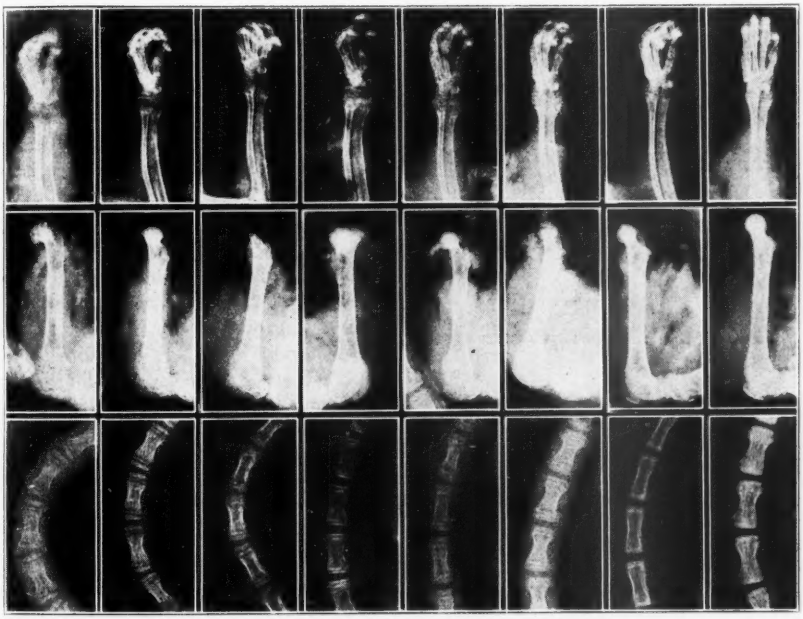

Fig. 7.—Progressive calcification with the amount of butter activators and a comparison with cod liver oil. Left to right: No activators; 0.5 per cent butter activators; 1 per cent butter activators; 2 per cent butter activators; 4 per cent butter activators; 8 per cent butter activators; 2 per cent cod liver oil; 2 per cent each cod liver oil and butter activators. There is a marked change in calcification with different percentages of butter activators and a striking difference in the last two of cod liver oil alone and cod liver oil plus butter activators.

Among the striking associated data reported by patients has been the general experience of increase in efficiency in school work and freedom from colds. During the past year, as has frequently

occurred in previous years, reports have been sent in by parents to the effect that the grades of their children were distinctly higher during the time of treatment than they had been previously. Probably no single criterion is more significant than the promptness with which telephone calls or telegrams are received if there has been a failure in receipt of the capsules on scheduled time. This, of course, applies chiefly to adults and older people.

During the decade that I have been working on the preventive program,

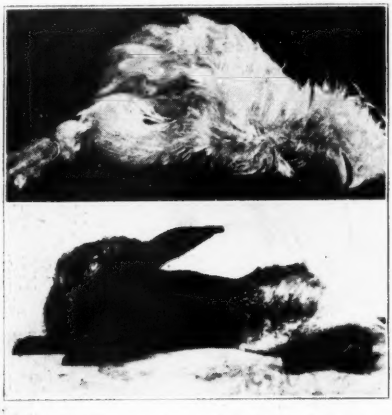

Fig. 8.—Progressive paralysis produced in a chicken and a rabbit, apparently by an overdose of cod liver oil. The daily quantity per body weight was approximately that often advocated for children.

there has been evidence of a progressive increase in the efficiency of the effort expended, in the light of the data just recorded, which are only a small part of the experience entering into the basis for judgment, which I interpret as indicating that dental caries can be very largely controlled at this time by the procedures I have used, which will be outlined.

It has been a common experience that clinicians have been observing persons of all ages who for an extended period have had no dental caries. It was found that this was not due to oral hygiene as a prophylactic procedure. It has been abundantly demonstrated that there was absence of dental caries in some persons making no effort at oral hygiene nor receiving a special dietary program.

Several workers of late have presented data indicating the important rôle of dietary factors in dental caries, among them Mellanby and Pattison[5] in England; Bunting and his associates[6]; Boyd, Drain and Nelson,[7] Hanke[8] and Howe.[9]

Mellanby has stressed the importance of vitamin D; Hanke and Howe have stressed the importance of vitamin C; Boyd, Drain and Nelson have stressed cod liver oil, milk, eggs and butter, and Bunting and his associates, the reduction of carbohydrates and a balanced diet. The last group has made an important contribution based on the clinical results obtained in several orphanges in Michigan. In their summary, they say:

1. In the study of the cause and control of dental caries, there is need for a fuller understanding of the basic facts concerning the diseases which have already been established. Many theories have been advanced which are not in accord with known facts.

2. Evidence is given in support of the view that dental caries is a specific infective process, the activity of which is dependent upon certain metabolic states.

3. As the result of dietary and therapeutic experiments, active dental caries was re-

5. Mellanby, May, and Pattison, C. L.: Brit. M. J., 2:1079 (Dec. 15) 1928.

6. Bunting, R. W., et al.: Am. J. Dis. Child. 40:536 (Sept.) 1930.

7. Boyd, J. D.; Drain, C. L., and Nelson, Martha V.: Am. J. Dis. Child., 38:721 (Oct.) 1929.

8. Hanke, M. T.: Relation of Diet to Caries and Other Dental Disorders, J.A.D.A., 16:2263 (Dec.) 1929.

9. Howe, P. R.: D. Cosmos, 62:921 (Aug.) 1920.

duced to a negligible quantity in 433 children. Of the methods employed, dietary measures appeared to be the most important.

4. The diets prescribed for the control of dental caries were well balanced, well fortified, adequate rations in which sugar was reduced to the minimum.

My studies have indicated that dental caries is a seasonal malady in large part, having its most rapid development from January to June, and having its lowest level of severity in the summer months and early autumn, which, as I have previously shown, is in accordance with the incidence of other diseases as I have discussed them in various phases of my recent reports.[10]

Among the important considerations, one which is being greatly emphasized at this time (I believe unduly so) deals with the structure of the teeth as influenced by environmental dietary conditions during the period of tooth development. The phase that I wish to discuss at this point is not the influence of the deficiency of the nutrition at the time the teeth were formed as a factor in the susceptibility to dental caries, but rather the fact that in persons with apparently well organized teeth in their embryonic and formative periods, and a history during a period of several years showing a complete freedom from dental caries, these same teeth, notwithstanding their good structure, may be attacked by rapid and serious dental caries in a relatively short time on a new dietary régime.

Many dentists have an opportunity to make observations of persons who have moved from southern European countries to our American environment. A large number of these persons arrive in this country at a susceptible age, namely, that of rapid growth. They have little or no dental caries on arrival, and a history of very little attention to oral hygiene. Often, within a year, these apparently unusually good teeth have been extensively attacked by dental caries. On inquiry, these people may say that they are eating the same food that they ate in southern Europe. This introduces several important problems, such as climate, sunshine, altitude and the actual difference in the intrinsic value of the same article of food when produced in a different district.

The work of Bunting and his associates emphasizes, and I think wisely so, the importance of limiting the carbohydrates, particularly sugars, partly for the purpose of preventing the satisfying of hunger with carbohydrates. It is of importance that, when possible, all children obtain a liberal supply of dairy products, including an abundance of fresh sweet milk.

One of the questions that we must consider critically is the relative value of the same food products when produced in different places at different times of the year. The suggestion that diet plays a very important part is illustrated in the following case.

10. Price, W. A.: Calcium Metabolism Studies on Nature and Rôle of Activators: Researches on Fundamentals for Prevention of Dental Disease, J.A.D.A., 16:265 (Feb.) 1929. New Fundamentals for Treatment and Prevention of Dental Caries Based on Calcium Utilization and Disturbance, with Special Consideration of Factors Determining When an Infected Tooth Becomes a Liability, J.A.D.A., 16:456 (March) 1929. Calcium and Phosphorus Utilization in Health and Disease; Certified Milk, J. Am. Ass'n M. Milk Commissions, October and November, 1929. Seasonal Variations in Butter-Fat Vitamins and Relation to Seasonal Morbidity, Including Dental Caries and Disturbed Calcification, J.A.D.A., 17:850-873 (May) 1930. New Standards for Dental Diagnosis, Am. D. Surgeon, 50:74 (Feb.) 1930. Why Annual Pilgrimages to Hospitals? Your Health (March) 1930. Footnote 3.

A girl, 14 years of age, was brought for consideration of a program which involved the extraction of all her remaining teeth and the insertion of full dentures because of very rapid dental caries from which she had suffered. An examination of her mouth in November, 1929, revealed that already eight molar teeth and one bicuspid had been extracted because of extensive dental caries. Nearly all of the remaining teeth had one or more cavities, some of them very extensive. The girl's health was not good and she had great difficulty in keeping up with her school work. A study of the dietary showed that this girl did not like milk and had been fed largely white flour products, syrup and sugars. Her favorite daily dish was pancakes swimming in syrup. Chemical and microscopic analyses were made of the blood, the saliva and the urine. We were amazed to find a very high level of albumin in the urine, i.e., 596 mg. per hundred cubic centimeters, or about 0.6 per cent of the total volume of the urine. After changing the diet to an increase in dairy products and a decrease in carbohydrates, particularly sugars and starches, and with an addition of minerals and vitamins, the urinary albumin in one week's time, dropped to 67 mg., and, in a few weeks, the albumin had entirely disappeared from the urine and at the same time there was a marked improvement in the appetite and physical well-being. Under the changed dietary program, in which additional vitamins were provided in capsule form obtained from a high vitamin butter together with a few drops of a high vitamin cod liver oil, this patient, during the next year, did not develop a single cavity and her physical well-being reached and remained at a high level. The roentgenograms of her teeth, taken in November, 1929, and October, 1930, are shown in Figure 5. In this case, evidence is strong that there was a deficiency in both the minerals and activators or vitamins in the food. Note that

Fig. 9.—Influence of butter vitamins. Left to right: Rat on diet deficient in phosphorus (Steenbock 2965), calcification deficient, with marked rickets (condition clinically inactive); rat on diet deficient in phosphorus (Steenbock 2965) plus 2.5 per cent cod liver oil, calcification improved, with healing two plus (progressive paralysis); rat on diet deficient in phosphorus (Steenbock 2965) plus 2.5 per cent cod liver oil and 2.5 per cent butter concentrate, calcification excellent, healing four plus clinically normally active). There is marked improvement in the calcification in the tail of rat 3, receiving both cod liver oil and butter concentrate, over that of rat 2, on cod liver oil alone.

some decalcified surfaces which were purposely left unfilled, did not have an extension of the caries. Also note that I had a root filling placed in a straight rooted tooth. The pulp was exposed but vital.

nutritional conditions which evidence a need in the body for activators as well as minerals for the control of dental caries. Since the activators furnished in separate form were of the fat-soluble group as obtained from a high vitamin

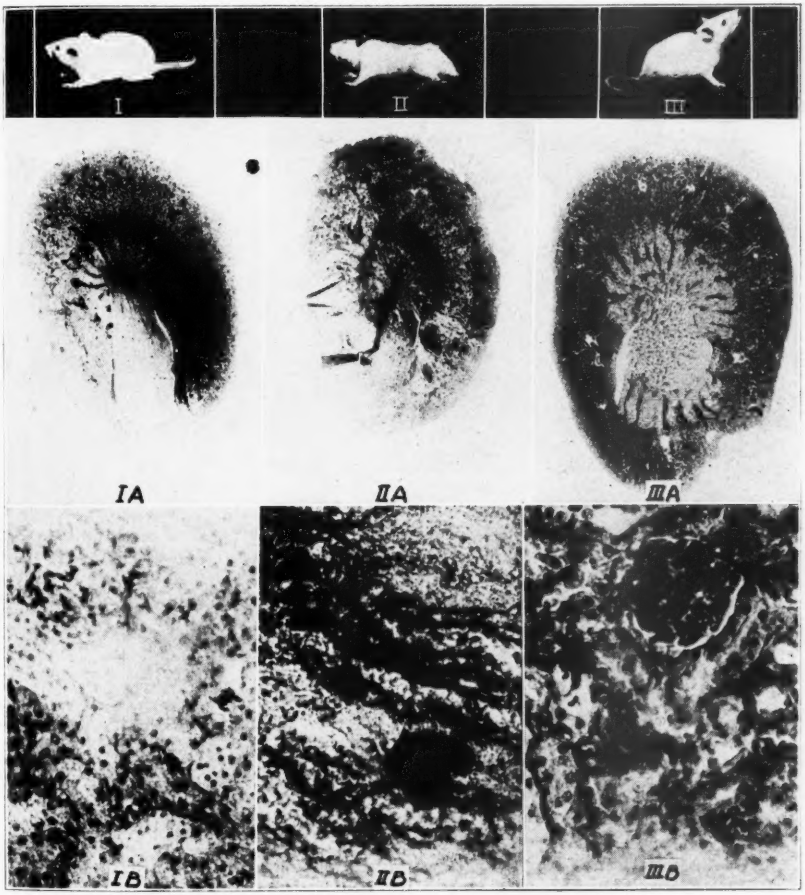

Fig. 10.—Influence of butter vitamins. Histologic appearance of kidneys of rats shown in Figure 9. The calcification produced by cod liver oil without butter activators and the better structure of the epithelial cells lining the uriniferous tubules and the glomeruli are evident.

From the cases and conditions cited, the evidence is that we are dealing with

butter together with a high vitamin cod liver oil, we have immediate need for

consideration as to whether any or all butters or any or all cod liver oils will satisfactorily accomplish this result. The fat-soluble vitamins as known are A, D and E, and evidence is strong that, associated with these factors, are many other activating substances not yet identified.

In my studies, I have placed much significance in the fact that all mam-

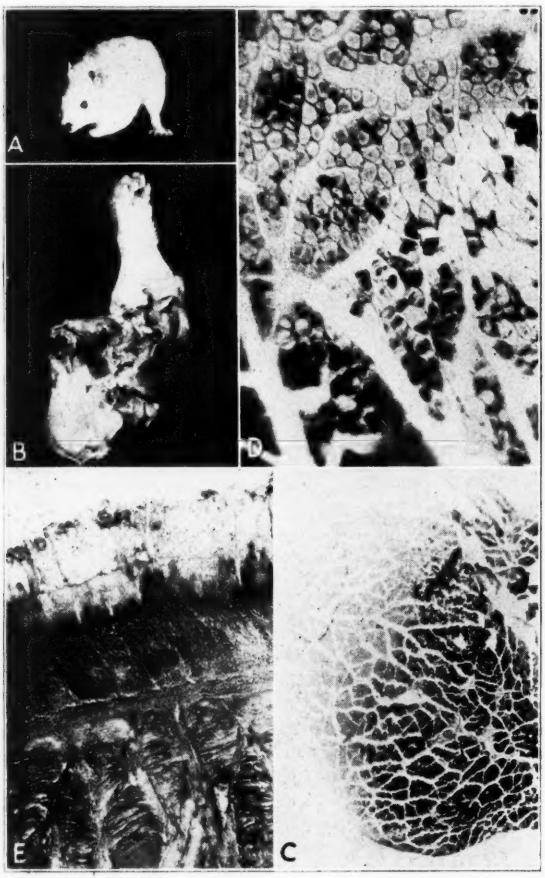

Fig. 11.—Tissue destruction produced by a toxic factor in cod liver oil. *A*, animal showing paralysis of foreleg; *B*, gross appearance of tissues; *C*, low magnification, showing boundary muscle degeneration; *D*, higher magnification, showing degeneration of muscle fibers; *E*, edema of tongue ten minutes after application of one drop. One of the toxic substances that have been found in cod liver oil is iso-amylamin, effects of which are shown above. Another is cholin.

mals start life on milk as the one and only complete food. Milk, therefore, must contain an adequate supply, under ideal conditions, of all the requirements both for dentition and for skeleton formation and for normal growth and function of the body, at least during the period of infancy. It is therefore very important that we study critically some of the effects of the activating substances in milk and its products.

I am now in the fifth year of analyzing in continually enlarging numbers and greater detail, milk and its products, chiefly butter, for their activator content with particular consideration of the fat-soluble vitamins. Samples of these products are now coming in every few weeks, mostly every two weeks, from several hundred places throughout the world, both north and south of the equator. These studies are showing a marked constancy in the repetition of the curves revealing a rise and fall in succeeding months of the year for various countries in both the northern and southern hemispheres. These studies are also relating the rise and fall of the butter vitamin level to the morbidity and mortality records of the various countries from which the samples are coming. These have been presented in progressive development of detail in various communications.[11] My data have revealed that dental caries follows a reverse phase from these vitamin curves, as do many of the morbidity curves.

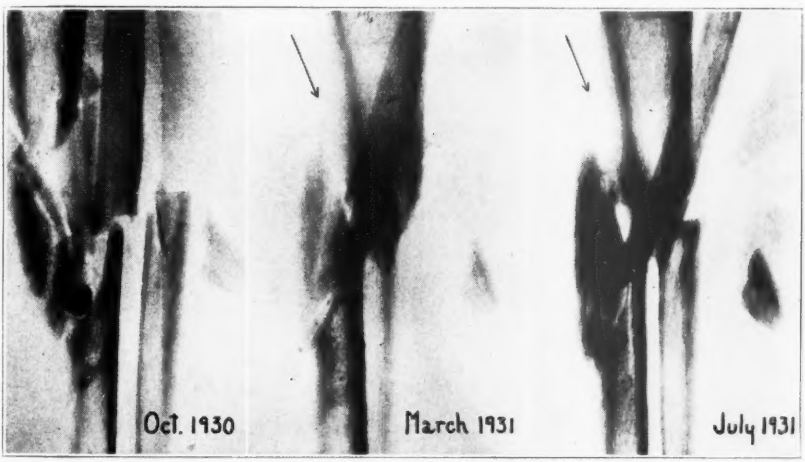

Fig. 12.—Healing of ununited fracture. Left to right: October, 1930; March, 1931; July, 1931. Healing delayed for five months was followed by rapid healing when the patient was given special vitamins. Arrow indicates the bridge of bone.

The indications from the available

11. Footnote 10, third, fourth and sixth references. Price, W. A.: Some Means for Improving Human Life by Increasing Vitamin Content of Milk and Products; J. Int. Ass'n Milk Dealers, January, 1931. New View of Dental Caries and Other Degenerative Diseases Based on Tides in Available Activators and Relation to Body Demands (unpublished data). New Light on Cause and Prevention of Dental Caries and Other Degenerative Diseases, Proc. VIIIth Internat. D. Cong., D. Survey, August, 1932.

data, some of which have just been outlined, would include the following: that dental caries can, under certain conditions, be controlled; that it is more rampant in that season of the year in which the general morbidity is highest; namely, the winter months. Dental caries seems apparently associated, therefore, with the same conditions as general morbidity. It is not necessarily dependent on a deficient structure of the teeth due to a disturbance at the time of tooth development. It is somewhat regional. A group of fat-soluble activators found in certain foods under certain conditions but not always present in sufficient amount in these foods must be considered. It is not to the extent generally supposed, dependent on the cleanliness of the tooth or teeth in question, and therefore is not controlled by oral hygiene. It tends to occur at periods of stress for the minerals utilized in building hard structures. It, therefore, may have even more significance as a symptom than as a disease, notwithstanding the intrinsic value of the teeth. It becomes important, therefore, to study critically some of the principles involved in the normal utilization of minerals for building of hard structures, as an approach to the specific problem of dental caries.

As an approach to this, we will study a typical lesion; namely, rickets in rats. In Figure 6 will be seen the foreleg and the tail as disclosed roentgenographically of two rats on the same deficiency diet, namely Steenbock 2965. It will immediately be seen that all of the bones of number 1 are very transparent and the carpal bones of the wrist have not formed. The junction of the epiphyses and the diaphyses of the bones, especially of the tail, is shown to be characterized by a zone of separation. In rat number 2, there is a marked density of the bones, seen as an opacity to the roentgen rays, and the carpal bones are well formed. The head of the humerus and the epiphyseal zones of provisional growth of the tail, are well calcified, with only a line of separation between them and the diaphyses. This rat received in addition to the deficiency diet,

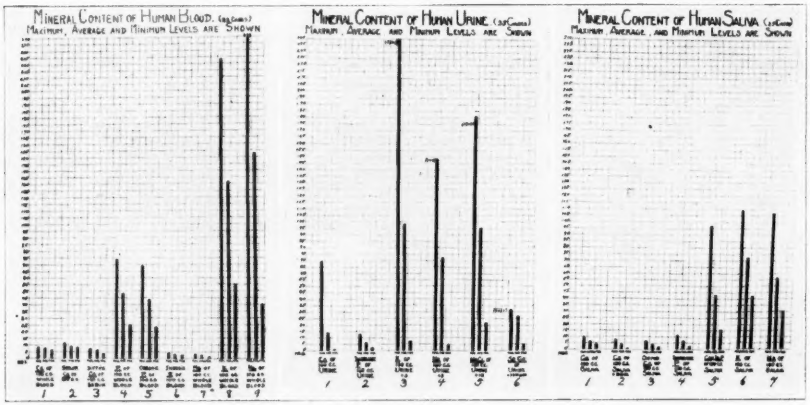
Mineral Content of Human Blood. (mg/cent)
Maximum, Average and Minimum Levels are Shown
Mineral Content of Human Urine. (mg/cent)
Maximum, Average and Minimum Levels are Shown
Mineral Content of Human Saliva. (mg/cent)
Maximum, Average, and Minimum Levels are Shown

Fig. 13.—Comparison of mineral content of blood, urine and saliva. This graph visualizes the relative and actual amounts of these various minerals in the body fluids and the daily depletion by way of the kidneys.

Steenbock 2965, 2 per cent of the diet as butter vitamin concentrate obtained from a high vitamin butter. Clinically, this condition constitutes healed rickets. This quantity of this butter would only constitute one-half ounce for a child eating 2 pounds of food per day. This is a very small quantity for a growing child. To the right in this illustration will be seen the mineral changes in the blood serum of these two rats. The calcium for rat number 1 is at 6.26 mg. per hundred cubic centimeters, and, in rat number 2, it is 8.4. The inorganic phosphorus in rat number 1 is at 1.93 mg. per hundred cubic centimeters, and, in rat number 2, it is 2.5 mg. We see at once that this clinical condition in these two rats is attended by certain characteristics in the blood chemical levels.

Fig. 14.—Normal and arthritic hand at age of 17. In the deformed hand, the radius and ulna are small and there is a dislocation.

The product that was administered to rat number 2 is a normal constituent of a normal milk, Nature's only complete diet for mammalian infants and by far the most important single item of food for growing human beings in all periods of stress.

Having indicated that the addition of a certain group of fat-soluble activators, some of which are the known vitamins, to the dietary of the individuals suffering from dental caries is at least one method which has been competent to reduce or overcome susceptibility to dental caries, there is immediate need for us to study the nature of the substances with which we are dealing. Since the

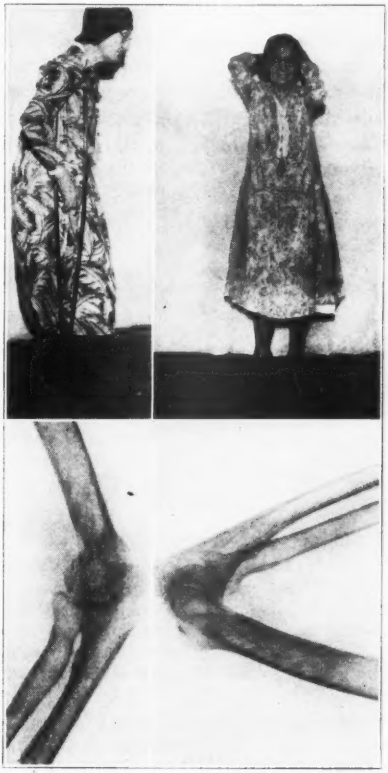

Fig. 15.—Marked improvement in deforming arthritis of long standing in a few months' time on special vitamins.

fat-soluble activators, some of which are the known vitamins, are recognized as existing in butter fat of milk and in certain fish oils, particularly cod liver oil, though in varying quantities in both, it is of particular importance to study some of the qualities which are characteristic of products obtained from these two sources.

Among the several specific investigations that I have made in order to study the relationship or characteristics of the administration of these two products to animals and to analyze them critically

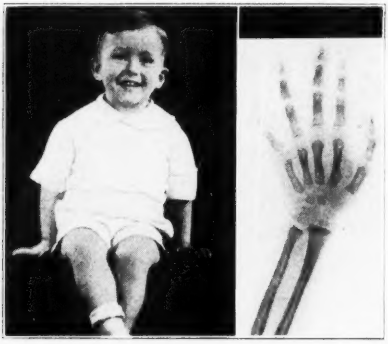

Fig. 16.—Butter vitamin fed boy who won a prize in a group of forty-one at 10 days of age. Neither this child nor his mother received cod liver oil or viosterol. Their fat-soluble activators have been provided from high vitamin milk, cream and butter which were specially selected by analysis.

to see the relative and actual effects is one shown in Figure 7. In this figure, there are eight groups of rats which have been fed a deficiency diet augmented by different amounts of various foods. One rat from each of the eight groups is shown in this study. These are marked 1 to 8. The roentgenograms shown for each rat are of the forepaw, disclosing the wrist, the femur and the tail. The only difference in the dietary intake consisted in a different quantity of the butter vitamin concentrate expressed as percentage of the diet in the first six rats. In the seventh, the activator used was cod liver oil alone; and, in the eighth, a mixture of the butter vitamins and the cod liver oil. Number 1 received no activators with its deficiency diet, and there will be seen at once not only that there is a lack of radiopacity of the various bony parts, but also that several of the bones are not completely formed or are absent. It will particularly be noted that the carpal bones are largely missing. The rat in group 2 received one part in 200 of its food as butter vitamin concentrate, or 0.5 per cent. This small amount produced a marked difference in the skeletal development, particularly as noted in the carpal bones. The relation of the epiphyses to the diaphyses of various bones is very easily seen in the bones of the tail. Group number 3 received 1 per cent of butter activators; group 4, 2 per cent; group 5, 4 per cent, and group 6, 8 per cent. It will be noted immediately that the density of calcification is progressive throughout the series. Group 7 received 2 per cent of cod liver oil, and it will be seen that there are certain structural characteristics of these rats that are different from those of the other rats. The shaft of the bones is longer than that of any of the rats in the butter vitamin group. The density of the calcification is not so great as in the rat on 8 per cent butter activator. The difference in these two activators will be seen in the following regards: The calcification is more diffuse in general in the butter group than in the cod liver oil group, and the epiphyses at their junctions with the diaphyses are shown to be more advanced in the closure of the interspace in the cod liver oil group than in the butter vitamin group. In group 8, which

received 2 per cent of cod liver oil and butter vitamin activators, it will be seen that all of these conditions are enhanced, all the bones being much larger and the development of the carpal bones more complete, and, in general, we have a result that is better than in either of the two when given separately. This series clearly demonstrates, as many of the others have done, the importance of butter and cod liver oil together as activators.

A need has been evident for additional data on the various characteristics of these two products as sources of activators in various nutritional phases of health and disease.

During the several years that I have been studying this phase of the problem, I have used several thousand chickens, rats and rabbits and other animals in my experiments, and I have made a study of a large group of human beings from both clinical and biochemical data. I have seen much evidence of toxic disturbance resulting from the administration of cod liver oil and other oils. Two illustrations will be seen in Figure 8, in each of which a chicken and a rabbit are shown to be partially paralyzed from the use of a quantity of cod liver oil which in proportion to body weight was approximately that frequently advocated. Agduhr[12] has reported extensive studies on mice, cats, calves and dogs. Rats, being scavengers, are less susceptible to injury from toxic substances than some other animals. They are sometimes affected though not so readily as mice, which Agduhr has used so extensively. He states that they die as early, but with fewer lesions.

12. Agduhr, Erik: Acta Paediat. 8:489, 1929. Agduhr, Erik, and Stenstrom, N: Acta Paediat., 9:229, 280, 307, 345; 10:167, 203, 271, 1930.

In Figure 9 will be seen an apparent influence of the activators from butter in neutralizing toxic effects produced by cod liver oil. The clinical result from using these two products in the combination in which I now use them has afforded an abundance of important data, which will be discussed presently. Rat 1 in this series received deficiency diet Steenbock 2965, low in phosphorus, and the roentgenograms of the tail show a marked deficiency in calcification which is characterized as severe rickets. Clinically, the animal had reached the stage in which it was inactive, which is characteristic of many animals on deficiency diets. Another characteristic of this diet is that it is low in mineral utilization activators. Rat 2 received the same diet as rat 1, but, in addition to the deficiency diet, received 2.5 per cent cod liver oil. Calcification is seen to be much better than in rat 1. The clinical condition of the rat was one of progressive paralysis. Rat 3 received the same diet and the same quantity of the same lot of cod liver oil, but in addition also received 2.5 per cent of butter concentrate. Calcification will be seen to be much better than that obtained with the cod liver oil alone and the rat was normally very active.

Histologic studies were made of various structures of these rats for use as comparative data. These are shown in vertical columns in Figure 10 for the kidneys. In *IA*, we see a low-power cross-section of the kidney of rat 1. *IIA* shows a low-power of a cross-section of the kidney of rat 2, and *IIIA*, a low-power of a cross-section of the kidney of rat 3. High-power views of these three structures are seen below the low-power views, as *IB*, *IIB* and *IIIB*. A marked difference will be seen at a glance. The kidney of rat 2 had so many islands of calcification that it was

difficult to cut it without tearing. These appeared as little stones all through the kidney cortex. This condition is evidenced by the torn state of the low-power section. One of the islands is seen in the high-power section *IIB*. There is a marked difference in the way the tissues took the stain. All were mounted on the same slide. Under the high magnification, as seen in the lower views, it will be noticed that the epithelial lining of the renal tubules is characterized by the flattening of the cells, with a marked change in the structural characteristics of the glomerulus. Those of rat 3 seem to be the only ones with approximately normal histologic structures, notwithstanding the fact that it had the same opportunity for injury as rat 2. Limited studies seem to have been made on the nature of toxic substances which may be present in cod liver oils. These are known chiefly from their clinical effects, which may be severe and striking. Only a small percentage of rats developed as marked injury as rat 2.

I have frequently had mothers bring this question to me as a serious nutritional problem with their children. They had desired to do all they possibly could for their children and, in their efforts, had tried to follow the directions on the bottle or as otherwise provided, which often meant large doses of cod liver oil. They have reported to me the difficulty they had in combating the rebellion of their children against the use of cod liver oil, which may have been in part a reaction of self-preservation. Many of the children were reported to regurgitate the oil when it was forced down. Since it has been demonstrated that only the oil that is utilized contributes to the well-being of the human being or animal, it can readily be anticipated that compulsion to take such a toxic product could be very injurious.

In studies to ascertain the nature of the toxic substances to be found in cod liver oil, Gautier and Mourgues[13] have found two particular substances which are very toxic; namely, isoamylamin and cholin. The former is found to be fatal in three minutes to a greenfinch in doses as small as 4 mg. Figure 11 shows the effect of injecting a small quantity of this material beneath the skin of a rat, shown in *A* to be carrying its foreleg. One small drop was placed subcutaneously in the center of its back and, on a later day, a small drop was injected under the skin of the abdomen. While these injections were not near the foreleg, the toxic substances extended their influence far beyond the local area of their insertion. The characteristic changes in the muscle color of the foreleg is shown in *B*. *C* shows a low-power section of the muscle of the foreleg. The boundary of the protoplasmic poison is clearly disclosed. *D* shows a high-power view of the degenerated muscle fibers, the dark cells showing clearly the effect of the progressive protoplasmic change. In order to study this product found in cod liver oil, I placed a small drop of it on the tongue of a rat. In five minutes, the tongue had changed color and was greatly swollen, and, in ten minutes, it was protruding from the rat's mouth. The animal was immediately chloroformed and the tongue removed for sectioning. The edema is shown in *E*, with the protoplasmic poison extending through the epithelial structure into the connective tissue. This shows the extreme toxicity of this substance. Little seems to have been reported on the toxic

13. Gautier and Mourgues: Compt. rend. Acad., 107:110, 1880.

substances in cod liver oil. Recently, Norris and Church[14] have called attention to the importance of considering the toxic substances in cod liver oils as possible explanation for differences in results obtained by different workers in vitamin studies.

Investigations made by Holmes and associates[15] have been directed toward a study of the influence on chickens of free fatty acids contained in four cod liver oils. Two were of low free fatty acid content; two, of high. The chickens on low fatty acid content oil developed into fowls of good quality. The death rate per hundred in these two groups was ten and fourteen, respectively; whereas, in the two groups receiving the high free fatty acid cod liver oil, the death rate was forty and twenty-eight, and of the birds that did not die, few showed normal pigmentation. All were listless and all were undesirable subjects for future experimentation.

The most important data that I have obtained directly or indirectly on the availability of cod liver oils that can provide what is required by the human body have come as a result of cod liver oil administrations to adults. These data indicate that this is not a satisfactory source of fat-soluble activators in ordinary diets. Experimental animals have the advantage of their availability for dissection and for reproducing the observations under controlled conditions. Neither children nor experimental animals can satisfactorily disclose their sensations, though much can be observed from their dispositions and evidence of well-being. It is clear from the many clinical data which I have accumulated that cod liver oil alone, as available on the markets, cannot provide all of the fat-soluble activators that we need, nor can it be taken for extended periods in large doses without the danger of undesirable results.

I have combined with the clinical experience of the patients evidence afforded by clinical and microscopic studies of the blood, saliva and urine and, by these means, have obtained information dealing directly with this problem of the availability of various substances as activators. The available data strongly indicate that there are marked limitations in the administration of available cod liver oils.

I have taken for granted in the discussion of this problem that it will be understood that the dietaries of patients are so arranged as to be what I deem adequate in vitamins B_1 (F), B_2 (G) and C.

In approaching a study of the etiology of dental caries, it is important that we learn as rapidly as possible the chemical processes involved in the utilization of the minerals of the foods and the significance of the variations in the chemical levels of the body fluids.

During the years that I have been studying these problems, I have placed increasing emphasis on the blood, saliva and urine chemical and microscopic pictures. These frequently reveal data strongly suggesting the nature of chemical imbalances, which, in many instances, can be improved through modification of the nutritional program. Study of the data obtained by these means will aid in visualizing some phases of this problem.

Among the many complicated mechanisms of the body which have to do with the maintenance of proper levels

14. Norris, E. R., and Church, A. E.: J. Biol. Chem., 89:421, 437 (Nov.) 1930.

15. Holmes, A. D., et al.: Does Cod Liver Oil of High Acid Content Have Toxic Properties? Poultry Science, 9 (March 1) 1930.

of various chemicals, some of which are the minerals which are in the various body fluids, is one with which we are greatly concerned and which has to do with the laying down and taking up of the hard tissues of the body. A physical condition which lends itself readily to a study of these phenomena has to do with mineral absorption and deposition, normal and abnormal, associated with progressive decalcification of the skeleton when the demands of the body for minerals exceeds the available minerals as obtained from the food. This condition is found in the changes of the bone which precede fractures that are spontaneously produced and in the progress Nature makes in the healing of such fractures. It is necessary to consider in detail progressive stages of calcification about the region of a fracture with a failure of union in which there is associated the roentgenographic evidence and the blood chemical data. These have shown, in several cases, progressive decalcification without union until the patients were placed under treatment providing important additions to the activators which seem to be requisite for the utilization of the minerals of the foods and for their deposition in the regions requiring them. These clinical data have also shown marked improvement in the calcification following an increase of activator intake. These data are of significance and interest when studied in connection with the blood chemical findings. Such a case is seen in Figure 12.

This man, aged 45, was shot in the leg in October, 1930. The bullet shattered both bones as is shown in the first view. The following March, owing to failure of union of the fracture, my assistance was sought. Blood was drawn and prepared according to my directions and sent to me by air mail for analysis. These studies revealed that the calcium, phosphorus and magnesium were each much below normal, being at levels 7.9, 3.3 and 1.7, respectively. The product of serum calcium and serum phosphorus, which is normal at about 40 for adults, was 26.1. Fractures do not heal readily when this product is below 35 and with great difficulty when it is below 30. In addition to suggestions relative to the foods to be selected and emphasized in the dietary program, capsules were sent containing the mixture of high vitamin cod liver oil and high vitamin butter concentrate. A rubbing oil (high vitamin cod liver oil activated in the sun for ten minutes) and a butter vitamin concentrate were also sent. Within ten days, the patient was conscious of a great reduction in pain and a sense of increasing strength, which progressed so rapidly that the cast was removed in a few weeks. In thirty-five days, as a result of this treatment, all of the chemical factors above mentioned increased considerably. The serum calcium went from 7.9 to 13.8; the serum phosphorus, from 3.3 to 4.3, the magnesium of the serum, from 1.7 to 1.9. The sum of the calcium and magnesium increased from 9.6 to 15.7, and the product of serum calcium and serum phosphorus advanced from 26.1 to 60.1. The patient was conscious of a great physical betterment. The roentgenographic picture of the bone, taken in March, at the time the treatment was started, is shown in comparison with the picture taken in July. It will be noted that, in the space between the large splinter and shaft of the tibia, a bony buttress has been built, by which time the leg was being used with comfort and efficiency. This is indicated by the arrow.

I have reported a number of cases of

ununited fracture in other communications.[16]

In order to better visualize the levels of the minerals in the body fluids in health and disease, particularly as variations of normality, I am presenting in Figure 13 a graph illustrating the levels for several chemicals in the blood, saliva and urine in twenty-five successive cases. This graph shows the highest, the lowest and average figures. It happened that no extreme cases appeared in this group. Several important facts will be observable at a glance, among them the following. The serum calcium varied from 10.7 to 8.1. The total phosphorus of 100 c.c. of whole blood, which will include the organic and inorganic phosphorus, is about five times that of the total calcium of 100 c.c. of whole blood, and of this phosphorus, by far the largest part is in organic combination. The inorganic phosphorus of 100 c.c. of whole blood is from a third to a half that of the calcium of 100 c.c. of whole blood. The magnesium of whole blood is about one-fourth that of the calcium. The two minerals that are present in largest quantities are potassium and sodium. It is seen at a glance that there is quite a marked difference between the maximum and minimum levels of all minerals, the maximum being from onefold to twofold greater in general for calcium, phosphorus and magnesium, and there is a much greater difference than this for potassium and sodium. The mineral content of human urine is seen to represent a large wastage, constituting that which has gone past the mill. It is not necessarily all wastage, though some of it is, as in the calcium of the urine in cases of infection, which may be distinctly an expression of undue wastage, the result in part of utilization of the available calcium of the blood stream for neutralizing toxic products due to infection. The minerals of the saliva tend to have a level that is related to the levels of the blood stream.

In a recent discussion of this problem,[4] I presented data indicating the mineral requirements of the body of animals, including human beings, each day. These have shown, for example, that a 1,000-pound cow requires 42 gm. of phosphorus, 63 gm. of calcium and 114 gm. of potassium, estimated as their oxids. Such a cow can eat approximately 56 pounds of fresh grass, which is 70 per cent water. An analysis of the grass produced in different locations immediately reveals that it is a physical impossibility for a cow to maintain life on the quantity of that grass which it is possible for her to eat. One of the grasses presented in that study, for example, furnished a total of 19 gm. of phosphorus a day; whereas, the cow required 42 for metabolism alone. The requirement for calcium was 63 gm., which was amply taken care of, the grass in question providing 199 gm. The cow would not fare so well for potassium, for her requirement for this mineral was 114 gm. a day, and this grass furnished only 11 gm. a day. The result was that even without the overload of pregnancy or lactation, the body became depleted, and these animals became ravenously hungry for minerals that they could not obtain from the diet. Throughout the world, animals express such hunger craving in abnormal chewing of various articles such as old bones, dirt and clothing. If this cow had the additional load of providing 5 gallons of milk a day, she would have to make large overdrafts on her stored minerals, since 5 gallons of milk requires 40 gm. of phosphorus in addition to that required for metabolism. The milk

16. Footnote 11, fourth reference.

would also require 34 gm. of calcium and 58 gm. of potassium. The total overload or shortage on this grass, which was obtained from a pasture on which the cattle were breaking in health, would constitute an overdraft of 63 gm. of phosphorus and 151 gm. of potassium. This pasture furnished an adequate quantity of calcium. Even the feeding of bone meal would not adequately furnish these minerals. It must be kept in mind that animals are dependent on plants to build the minerals into organic structures in order to provide the building blocks of the body. It has not been appreciated that there is a great difference in the content of various chemicals constituting the structure of plants with which we are familiar and which are being used for food for both human beings and domestic animals. In a chart which I have presented in the above-mentioned research reports,[17] I have shown the variations in the content of several minerals in each of eight different grasses which I have analyzed. The range of each is very great, potassium having a range of 1 to 50, phosphorus, 1 to 60, and calcium, 1 to 10. A discussion of this phase of the problem should be included here, if space permited.

We find ourselves confronted with a problem whose complexities have baffled science throughout all history. Why is it that some individuals suffer from dental caries and others do not, and why does one individual suffer at a particular period of life and not at another? One after another, theories have been presented which have been proved inadequate. Mistaken concepts have been costly to humanity in general. It would be exceedingly difficult to estimate the harm that has been and is being done through the mistaken guarantees of oral hygiene; not that oral hygiene is undesirable, but it must not be taught or be understood by the public that cleanliness alone can prevent dental caries. If "cleanliness is next to godliness," nutrition must be a part of godliness.

I am continually receiving communications from various districts inquiring as to why it is that the members of a given family or the inhabitants of a given district are so subject to dental caries. A dentist writing from a city in a large central state recently asked why is it that I find more dental caries in the mouths of the present generation of growing boys and girls than in any generation I have taken care of in the past thirty years, and why the condition is so progressive. It is also significant that about that same time I received from the agricultural department of that state a reply to my inquiry regarding soil depletion, stating that the carrying capacity of the pasturage lands and the crop capacity of the tilled lands of that state have decreased conspicuously in the last two or three decades, the reduction amounting in some sections of the state to 50 per cent in carrying capacity on pasturage areas. The experience of this state is not more striking than that I could cite for many other states. There is probably more evidence of an association of nutritional deficiency in animals and human beings in the same districts than has been suspected. I have presented data on this point in some of my reports.

Nutrition is dependent on three principal food factors: (1) energy-producing elements for maintenance of temperature and energy expenditure, etc.; (2) minerals and other chemicals that are essential for the building and repair of tissues and for tissue function, and (3) activating substances, which seem to

17. Footnote 1 and Footnote 11, second reference.

have a combined rôle of making the minerals and other chemicals available for utilization and also for entering into the structure of different types of tissues.

The general use of the term "diet" has not adequately taken into consideration relative values. I have already referred to variation in values of milk and have reported extensively on this phase of the problem. Too little attention has also been given to this matter of the depletion of cereal foods of their desirable if not essential factors. I recently asked a miller how long he would expect whole wheat flour to be available for use in the summer time if all of the ingredients of the wheat kernel were left in it, he said, "Only a few weeks." When I asked why, he said, "It would be swarming with flour mites."

When we study the civilizations preceding ours and for whom we have too little admiration and sometimes even disdain, we find that they did not take out of the food these substances that would generate life within two weeks. A phase of my program, particularly in cases showing severe nutritional disturbances is not only to provide the minerals in as great or even greater quantities than are found in the whole grains, preferably wheat, but also to add an additional quantity of fresh activators as found in the germ of the wheat by providing additional strictly fresh wheat germ, which, in warm weather, rapidly deteriorates after the grain is broken.

In several of my recent research reports previously referred to, I have presented data relating morbidity and mortality for many diseases to the levels of the vitamins as found in dairy products in various districts when the United States and Canada are divided into sixteen large geographical areas. This implies that other food plants have many factors in common with a stored or growing grass which produced the milk in a given district.

Space here will permit only a summary of the factors which I deem to be of primary importance in the causation of dental caries. The following general statements present my point of view:

1. Dental caries, while considered to be the most widely distributed disease in the world, does not attack the same individuals equally at all periods of life or all the individuals in the community to the same degree at a given time. Therefore, it is not endemic.

2. It has not been controlled or greatly reduced by oral hygiene.

3. There is much evidence of an increase in the severity of dental caries in certain districts in spite of all advances in medical and dental science.

4. It attacks individuals most severely at certain periods which are known as periods of stress, particularly those of rapid growth, sickness, physical and nervous overload and pregnancy.

5. It tends to be seasonal with regard to its periods of greatest severity in given individuals, being most severe in the time of reduction of vitamins in foods and periods of rapid growth in children. Its periods of activity are associated with depression of some of the minerals of the foods, particularly calcium and phosphorus. Activity largely ceases when the balance in blood minerals is changed from a negative to a positive phase. The food factors which produce these changes in the essential blood chemical elements, while related in some degree to most, if not all, the known vitamins, are apparently chiefly related to a group of fat-soluble activators, which includes the known fat-soluble vitamins.

6. The dietary sources of these fat-soluble activators are more limited than are the sources of most of the water-solu-

ble activators. The only liberal sources are certain samples of milk fat and cod liver oils. Milk growth-activators are, in the light of my studies, chiefly produced by animals feeding upon rapidly growing young plant life. For the cow, this means that it is restricted largely to the periods of the year when her diet consists chiefly of rapidly growing young grass or the same cured and stored in such a manner as to retain these factors. The milk-fat products which contain the highest levels of these activating substances can be stored at low temperatures, when properly prepared for storing, for extended periods exceeding one year, and can thus be made available.

7. Water-soluble activators are essential and fortunately are usually easily obtained. They also greatly stimulate the appetite. Working oxen will live on a diet on which calves and cows die.

I can probably best illustrate my procedure and demonstrate the constitutional changes affected by a change in the nutritional program by a practical case which involves several phases of physical evidence of disturbed nutrition, including extensive dental caries with structural change often associated with infection processes.

During the past decade much advance has been made in our knowledge of the relation of infection of the teeth and mouth, particularly apical infection of pulpless teeth, to disturbances in other parts of the body. These studies have shown that inheritance plays an important part in determining the type of tissue that would be affected in a given individual. Susceptibility of an organ and tissue has also been shown to be related to physical overloads and to nutritional stresses. One of the important afflictions that has been associated very closely with dental infections is arthritis. While many persons improved after the removal of dental infections, many did not or experienced only a cessation in the activity of the process.

An important new phase of these studies is the marked improvement in the physical condition of persons who are below par in general health and also, in many instances, a lessening of disturbances in organs and tissues. This improvement has been particularly striking in many cases of arthritis after the use of the activators that are found to be helpful in reducing dental caries.

My assistance was requested by the visiting nurses' association to aid a young girl whose condition was said to have been reported as incurable. She was 17 years of age and bed-ridden, with acute multiple deforming arthritis associated with so much pain that she would cry by the hour day after day from her distress. She could scarcely move a joint of her body, many of them being rigidly ankylosed. Her condition had been getting progressively worse since she was 5 years of age, at which time she had five abscessed deciduous teeth, which, of course, means that she had extensive dental caries. She was brought in in an ambulance. Her parents reported that she had been having on an average of three to four convulsions a week, usually brought on by the pain when she was moved to make her comfortable. At times, she had great difficulty in breathing. Her mouth would open only a short distance but some roentgenograms of her teeth were obtained and many of the teeth had extensive dental caries, some with pulp involvements. It is important that the teeth with pulp involvement showed little apical change. Owing to the spasms of the muscles of the left side of the neck, the head was drawn so tightly into the shoulder that it was difficult to get more than the thick-

ness of a towel between. The spasms of these muscles had continued for months, causing intense pain. The roentgenograms of the chest, neck and head showed that the mouth, instead of being crossways to the spinal column, was parallel with it. The vertebrae of the spine were rigidly ankylosed so that the patient was locked in this position. A lower molar tooth on the left side had serious pulp involvement and the history indicated that the toxic products from this infected tooth and probably other infected teeth of the left side traveled through the lymphatics into the musculature of the neck, producing torticollis. Neck involvement, particularly neuritis, rye-neck or torticollis and neuralgia, are common expressions of the presence of toxic material from dental conditions, which may be without local dental symptoms.

We must ask ourselves what the contributing factors are in such a tragedy. It began at 5 years of age when the patient had the five abscessed teeth. Clearly, there had been nutritional deficiency, for, in the light of our newer knowledge, dental caries is primarily nutritional. The evidence developed indicates an inherited susceptibility in that the mother and the brother have had inflammatory rheumatism, although not in severe form. The convulsions clearly indicated, as did also the unstable condition of the nervous system, a low threshold for calcium, which, on chemical analysis, was found to be 8.3, and the cell calcium one of the lowest we have ever determined, at 0.02. The body was evidently making a heroic effort to maintain levels by utilizing available minerals. The cell volume was exceedingly low at 25 per cent; potassium and magnesium were both low, and sedimentation time of the blood was extremely rapid. Examination of the dietary indicated a lack of minerals and activators. In order to illustrate the long-continued nutritional handicap of this girl, I am showing in Figure 14 a picture of a hand and forearm of a normal girl of 17 and the hand and forearm of the patient for comparison. It will be seen not only that there is marked dislocation and deformity of bony structures but also that there is a marked difference in the size of the bones of the forearm in comparison with that of a normal girl. Doubtless, Nature did the best she could with the scanty and depleted diet available from the refined flour foods and depleted activator content of available dairy products. She was placed on the special activator mixture in capsule form to which I have referred, and given as one of her important food constituents a whole wheat ground freshly every few days, to which, after it was cooked, was added a quantity of fresh wheat germ, about one tenth the volume of the ground wheat. This was added when it was ready to be taken off the stove. It was then allowed to cool on the side of the stove. Milk, fruits, vegetables, whole wheat bread, etc., were advised. The results were most striking. The convulsions which she had been having on the average of once every other day, ceased immediately and she did not have one after starting the capsules and special foods. Instead of eating two meals a day, she ate three or four. The pain was so reduced that she was not disturbed except slightly when lifted. The movement of the joints increased so much that within a month she could open her mouth twice as far as at the beginning, which permitted the removal of one of the infected teeth. Many teeth had been filled. This terrible condition of progressive locking of the joints with acute inflammatory processes was reversed, and she progressively improved. Pains subsided, swelling was reduced and some movement of fixed

joints developed in a few weeks, so that she could feed herself and turn the pages of a book. She again became interested in the world and in living.

Another instructive case is illustrated in Figure 15. This woman, 61 years of age, had suffered severely with arthritis for nine years and, for the past eight years, had not been able to wear shoes or move about except with great difficulty and assistance, part of the time being bedridden. She had not walked without crutches for seven years, except for a period of about three months. Her pain had been so severe that seldom was she able to get to sleep before 4 o'clock in the morning. Her teeth were removed early, many being infected. There was a history of severe dental caries. Much effort had been made to furnish relief. The fingers and thumbs of both hands had been held apart for years. Within a few weeks after starting the treatment, the pain was much reduced and she was able to sleep soundly all night. She now has no pain day or night after being under treatment for eight months. She has resumed her activities as a seamstress and has regained the use of her arms so that she can put her hands behind her head as is shown in the illustration. She now has no use for crutches except to steady herself going up and down the stairs. Physically, she looks greatly improved, and she states that she is perfectly well except for the retained stiffness, chiefly in her back, which is progressively decreasing.

All that has been done is to add to her diet the vitamin concentrate and a small quantity of high vitamin cod liver oil. The latter had been used alone before at various times without success. There was little movement in the left elbow joint when the treatment began, the arm being in a nearly straight position. The present range of movement is shown by the two roentgenograms and the photograph in Figure 15. The patient states that she has never felt better since she was 30 years of age. No considerable changes were made in her diet because it was found to be quite ample.

A difficult and serious phase of the problems is this: we cannot write out a formula to be taken to the grocer's to obtain the cereal products containing both high minerals and their natural activating substances as found in the germ, or to obtain butter and milks that are known to be amply high in their activating substances. And least of all can we go to the drug store and buy these as chemicals, since the very nature of animal life is such that the tissues are built of substances that first must be constructed by a plant and therefore are organic. We cannot substitute inorganic chemicals.

Accumulating evidence indicates that dental caries and the lowering of levels of fat-soluble activators in dairy products are progressing simultaneously in those districts that have been longest under cultivation without mineral replenishment and enrichment of the soils, and that these conditions are accompanied by an increase in morbidity and mortality suggesting, if not indicating, a relation that is not a simple coincidence. From data obtained from the analysis of dairy products, chiefly butter, from many places throughout the world and the correlation of these data with the morbidity cycles of the same districts, I find conditions which I interpret to indicate that the degenerative diseases in many of their other expressions are largely if not chiefly the same in their seasonal expressions, as the tides in the vitamin content of foods. Even the demand for beds in hospitals for medical cases reflects this same cycle. It is also exceedingly significant that the increase in certain of the mortality rates

can apparently be explained on this same basis. I have presented data dealing with these phases in reports entitled "Why the Annual Pilgrimages to the Hospitals?"[18] and in "A New View of Health and Disease Based on a Rise and Fall in Vitamin Tides."[19] It is important that persons who tend to develop heart trouble in childhood (and 90 per cent of all heart cases begin before 10 years of age) as a rule, have been very susceptible to dental caries. We see direct evidence as to why dental caries and rickets together of all problems offer the greatest challenge to civilization and why these evils are the foremost enemies of the Nordic race in the temperate zone. This is another way of stating that our greatest problem is the supply and utilization of minerals.

If my interpretation of the data available is correct, diets as built by name for different communities do not necessarily provide the same nutritional factors. This may also be true of the same place at different times of the year owing to the different values of the same foods. Accordingly, in the light of these observations and clinical experiences, it will be necessary to reinforce given foods with adequate activators, when they are not present in sufficient quantities in those foods. The best means that I have found for accomplishing this, and which is supported by clinical, laboratory and experimental data, is to select milk fats that are high in these activators and preserve them either in natural form or in concentrated form for periods of stress and vitamin shortage in the available foods.

The means I have found most readily available for identifying milk, creams and butters that are sufficiently high in the activating substances with which we are concerned has been the use of both animal-feeding tests and chemical tests for the activating substances. I have used the antimony trichlorid method of Carr and Price,[20] adapted to butter products for vitamin A, and the hydriodic acid method of Yoder[21] for vitamins in the D group. The vitamin content of the cod liver oil should be over fifteen Lovibond units for vitamin A on the standard suggested by Drummond and Hilditch. A good technic is described in their report before the Empire Marketing Board entitled "The Relative Values of Cod Liver Oils from Various Sources."[22] I have reported at length, at various times, details regarding the many thousands of samples of butter that are tested each year from all over the world, largely from the same places regularly each month or fortnight. When butters of high vitamin content are located and secured, the low melting factors are removed by centrifuging at a proper temperature. This product is what I term the high vitamin concentrate. It is liquid in ordinary room temperature. The high vitamin milk is produced by dairy animals best, if not only, when the animals are on a rapidly growing plant life, such as succulent young grass. One of the best that I have found of the few pasturages that are especially good is rapidly growing young green wheat. The butter product is mixed with about equal parts of a very high vitamin cod liver oil with variations in proportions according to clinical conditions. This combination

18. Footnote 10, sixth reference.

19. Price, W. A.: New View of Health and Disease Based on Rise and Fall in Vitamin Tides, Am. J. Pub. Health, 21:605 (June) 1931.

20. Carr, F. H., and Price, E. A.: Biochem. J., 20:497, 1926.

21. Yoder, L.: J. Biol. Chem., 70:297 (Oct.) 1926.

22. Drummond, J. C., and Hilditch, T. P.: Relative Values of Cod Liver Oils from Various Sources (published by His Majesty's Stationery Office, London, December, 1930).

is placed in a capsule containing about 0.6 gm. (the 0 size). Two or three of these capsules are administered with each meal with a dietary adjusted to provide minerals and other nutritional factors, including the water-soluble vitamins. Since these are food products and are used to reinforce the available foods with nutritional factors, I deem it proper to say that we have by this means, and perhaps other dietary means, found a method for the control of dental caries.

I have undertaken to check the incidence of dental caries in various communities against the vitamin content of the foods in the communities. One of the studies in this connection which I have in process is being made in Switzerland. During the past summer, after the International Dental Congress at Paris, I made a limited study of dental caries in Switzerland, where I found the record of the observations of the dentist to indicate that this condition was very prevalent. I was advised by a government official that dental caries was the most serious disease in Switzerland. Through this official's assistance, I was able to locate a group of people that had little access to the various food resources of the country, and who for centuries have provided nearly all of their nutritional elements in their own high valley. I examined a large number of children in this valley which was quite difficult of access, and found their teeth almost completely free from dental caries. They live largely on their native grains, plant foods and dairy products, the latter forming an important part of the diet. The dairy products are obtained from both cows and goats. Samples that I am obtaining from that valley indicate that this butter is of exceptionally high vitamin content.

I examined children reared in other vallies, but where the trains bring modern dietary products, and found dental caries rampant. This study will be reported in detail in another communication and is being extended.

I cannot include here, as would be desirable if space permitted, data concerning the most available forms of the minerals and other nutritional factors.

The activators essential for the utilization of the various minerals and other chemicals for the building and maintenance of bodily tissues are provided in an ideal milk as designed by Nature. Since we all start life on that food as provided by Nature for all mammals, it is the most natural source of these activators.

An illustration of the consistency and efficiency of the nutritional program which is developing as a result of my research is found in the following case (Fig. 16), which indicates its helpfulness in the development of the child during fetal life, his nourishment during lactation and early childhood and the protection of the physical welfare of the mother, including complete freedom from dental caries. This boy, 2½ years of age, has never received directly or indirectly any cod liver oil. He has obtained fat-soluble activators through his mother during gestation and lactation from milk and butter of high vitamin content as determined and selected by the tests indicated and, since weening, he has obtained his additional fat-soluble activators entirely through the use of high vitamin butters. He won a prize at 10 days of age for being the best developed, having the best disposition and being the best nourished infant in a group of forty that were in the maternity hospital at that time, and this notwithstanding the fact that he was a first child and that the mother was frail. The excellent structure of his bones is shown in the accompanying roentgenogram. In physical development, he has always been

exceptional. He was the only child on this dietary program.

Many of the children who have been on my nutritional program through their entire life, some of whom have all their deciduous teeth, have never had a sign of dental caries. The joints are well formed and seem to justify the belief that the addition of fat-soluble activators in suitable quantity and adequate quality is capable of reinforcing available foods sufficiently to assure a physical development of a high standard.

SUMMARY

The data presented are interpreted to indicate the following:

1. Dental caries can be largely prevented or controlled.

2. This result can be obtained by the selection of particular samples of foods that are sufficiently high in minerals and activators to provide the nutritional requirements of the human child and adult, including the expectant and nursing mother.

3. While some of the necessary activating substances are found in certain samples of dairy products, milk, cream and butter, many of the readily available products are not adequately high in these activating factors.

4. Cod liver oil is available as a source of reinforcement of dairy products, plant and animal foods. While it has great value, it may contain and probably often does contain substances which are undesirable; therefore, it should be given in small doses, and only products of the highest natural vitamin content be used.

5. The available data strongly suggest, if they do not indicate, that dental caries is primarily an expression of nutritional disturbance in which the teeth become susceptible to attack by the products of acid-producing bacteria. The progress of this decalcification is inhibited by the presence of proper chemicals in the blood and the saliva. Many dietaries provided for children and adults are deficient in activators, chiefly the fat-soluble. While a deficient food may become adequate by increasing the quantity of fat-soluble activators, we must always realize that the water-soluble activators must be present and must also be supplied if not present.

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ELECTROMEDICATION AS USED IN PERIAPICAL INFECTION*

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THE word "medication" means the application or administration of drugs. The prefix "electro" indicates that electricity was used as an essential part of the method of application or administration.

The time is appropriate for a review of this subject. The year just past marked the centennary of Faraday's great discovery of electromagnetic induction. Although we are not now concerned with this phase of Faraday's work, he was the first to see clearly and to describe and classify certain phenomena which are fundamental to electromedication. We are

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all acquainted with, and are sometimes somewhat confused by, certain terms—electrode, anode, cathode, ion, cathion, anion. Let us see if Faraday's own words, in his "Experimental Researches in Electricity," will set us right on these points.

> In place of the term pole, I propose using that of Electrode, and I mean thereby that substance, or rather surface, whether of air, water, metal, or any other body, which bounds the extent of the decomposing matter in the direction of the electric current. . . . Wishing for a natural standard of electric direction to which I might refer these (the electrodes), expressive of their difference and at the same time free from all theory I have thought it might be found in the earth. If the magnetism of the earth be due to electric currents passing round it, the latter must be in a constant direction, which, according to present usage of speech, would be from east to west, or, which will strengthen this help to the memory, that in which the sun appears to move. If in any case of electro-decomposition we consider the decomposing body as placed so that the current passing through it shall be in the same direction, and parallel to that supposed to exist in the earth, then the surfaces (electrodes) at which the electricity is passing into and out of the substance would have an invariable reference and exhibit constantly the same relations of powers. Upon this notion we purpose calling that towards the east the *anode* (upwards and away; the way which the sun rises), and that towards the west the *cathode* (downwards and away; the way which the sun sets. . . .

At the present time, the use of electromedication in dentistry is practically limited to the treatment of periapical infection, and to the treatment of what is commonly called "pyorrhea alveolaris."

I shall on the present occasion confine myself to the treatment of periapical infection. I shall first discuss some of the technical problems which have aroused the most interest and about which the greatest diversity of opinion exists.

1. What material shall be used for the active electrode? Copper, zinc, "stainless" steel and iridioplatinum have been advocated. The fact that copper and "stainless" steel stain dentin automatically removes these materials from further consideration in connection with the treatment of periapical infection. Grossman and I[1] have shown that a zinc electrode gives a greater antibacterial effect than an iridioplatinum electrode when the electrolyte is sodium chlorid, and that when the electrolyte is zinc chlorid or zinc-iodid-iodin solution, there is little difference in the degree of antibacterial effect. An attempt was made to secure what in effect would be a zinc electrode possessing the physical advantages of iridioplatinum by coating an iridioplatinum electrode with zinc. Clinically, this proved impracticable. For routine use, an iridioplatinum electrode is recommended for employment with a zinc-iodid-iodin electrolyte.

Copper has been used as the active electrode in the treatment of fistula (Sturridge)[2] and, for this purpose, there is no objection on the ground of discoloration. Zinc and iridioplatinum electrodes have also been used in fistula.

2. To which pole of the battery should the active electrode be attached? To answer this intelligently, the electrolyte would have to be considered. Zierler,[3] using 1 per cent sodium chlorid, advised the employment of the positive pole because in *in vitro* experiments by far the greater antibacterial effect was obtained around the positive electrode. Likewise, Ohngemach,[4] using agar plates heavily

1. Grossman, L. I., and Appleton, J. L. T.: D. Cosmos, 73:147 (Feb.) 1931.

2. Sturridge, Ernest: Electrotherapy in Periodontal Disease and Root-Canal Sterilization, J. A. D. A., 14:1867-1873 (Oct.) 1927.

3. Zierler, F. E.: Beiträge zur Behandlung putrider Zahnwurzeln, Würzburg: A. Stuber, 1905.

4. Ohngemach, Fritz: Die elektro-sterilization der infizierten wurzelkänale, Zahnaerztl. Rundsch., 34:106-108, 124-127, 1925.

inoculated with the streptococcus and staphylococcus and *B. mesentericus* found distinctly the greater antibacterial effect around the positive pole. Grossman and I,[5] using more than fifty different combinations and concentrations of chemical compounds, also *in vitro* experiments, confirmed and extended Zierler's advice. In all this *in vitro* work, the antibacterial effect was proved to be bactericidal. Frank D. Price[6] used a positive zinc electrode in the canal with zinc chlorid or a negative zinc electrode with iodin or oxygen (sic). Prinz,[7] closely following Zierler's work, used a positive iridioplatinum electrode with a sodium chlorid solution. Custer[8] used a positive zinc electrode in the canal with surgical solution of chlorinated soda or alcohol plus sodium chlorid. LaRoche[9] used a negative platinum electrode for the first and second treatments, changing to a positive electrode for the third treatment. The composition of the curious solution which he used will be given later. Stoloff[10] used the negative pole in the canal, as did also Johnston,[11] who strongly recommended Churchill's tincture of iodin. Sturridge[12] used a positive platinum electrode with 3 per cent zinc chlorid. Tritschler,[13] in a pretentious paper, gives only three cases which are of interest to us at the present moment. In one, he used a negative electrode with "iothion"; in a second, he used a positive electrode with silver citrate, and, in the third, he used a positive electrode with colloidal silver and mercury (1:1).

It is indeed fortunate that Nature has supplied us with only two poles, or greater diversity would have appeared in the recommendations made and the situation would be still more complicated.

The reasoning which has led some men to use the positive pole and some the negative has often been *a priori,* and based on misunderstood or incorrect premises. *A priori* reasoning, because it is unreliable at best in such matters, should never be depended on longer than is necessary; i. e., until a direct appeal can be made to the facts.

At the present time, the weight of evidence seems to favor the choice of the positive pole, because (1) *in vitro* experiments uniformly show it to be the site of the greater antibacterial effect; (2) less gas is evolved at the positive than at the negative pole, and thus there is at least less technical annoyance[3]; (3) the sodium hydroxid evolved at the negative pole is undesirable because of its caustic

5. Grossman, L. I., and Appleton, J. L. T., Jr.: Experimental and Applied Studies in Electro-Sterilization, D. Cosmos, 73:147 (Feb.) 1931.

6. Price, F. D.: Ionization Method of Treating Alveolar Abscess, Dominion D. J., 28:173-179 (May 15) 1916.

7. Prinz, Hermann: Electro-Sterilization of Root Canals, D. Cosmos 59:373-394 (April) 1917.

8. Custer, L. E.: Method for Electro-Sterilization and for Root-Filling with Zinc Chlorid and Metallic Zinc Cone, D. Summary, 38:399-404 (June) 1918.

9. La Roche, Montgomery: Improved Method of Sterilization of Infected Teeth, J. N. D. A., 5:1142-1144 (Nov.) 1918.

10. Stoloff, C. I.: Conservation of Pulpless Teeth by Application of Ionization, D. Cosmos, 65:732-735 (July) 1923.

11. Johnston, H. B.: Pulp-Canal Opening and Filling by Diffusion; Technique and Results of Electrolytic Medication, D. Cosmos, 65:577-585 (June), 749-763 (disc.) (July) 1923.

12. Sturridge, Ernest: Ionization in Root-Canal Work, Brit. D. J., 44:1420-1424 (Dec. 15) 1923.

13. Tritschler, Max: Die electrophorese in der zahnheilkunde, Deutsch. Zahnhlk., 57:1-51, 1923.

action[14]; (4) physiologically, the irritability is lowered at the positive pole, which clinically may mean less discomfort to the patient; (5) theoretically, bacteria carry a negative charge and are therefore electrophoretically repelled by the negative pole and attracted toward the positive pole.

The repulsion of bacteria would mean a wider distribution through the tissues away from the antibacterial forces mobilized at the tooth apex. Their attraction would mean concentration nearer the apex of the tooth, where presumably the antibacterial effects of the treatment would be most powerful. Not enough consideration has hitherto been given to this possibility. LaRoche[15] used a negative pole in the canal to "avoid spreading bacteria and their products through the tissues by the cataphoresis set up by the current." This is, of course, just what the negative pole in the canal would *not* do. If anything, it would tend to spread the bacteria out more widely, centrifugally from the apex. Ohngemach[4] surmised that bacteria would be attracted toward the positive pole. In support of this view, I shall quote from a letter from Stuart Mudd, M.D.: "There is good reason to suppose that bacteria, when in the human body, possess a negative charge."

These five points seem all that can be urged at present in favor of choosing the positive for the active electrode. I frankly admit they do not suffice for us to consider the subject settled. It has not yet been proved that under clinical conditions the positive pole in the canal is more effective than the negative. It will not be easy to decide, but no practitioner who is interested in this method should rest until it has been decided.

3. Should single or multiple electrodes be used? According to Prinz,[7] "each root canal of a multi-rooted tooth is preferably treated separately." Experimental evidence is given by Pond and Price[16] that the logical procedure is to place the electrode in one root (of multi-rooted teeth) at a time. Johnston[17] used multiple electrodes. It was asserted by Sturridge[12] that if two or three canals exist, they can all be "ionized" at the same time by introducing an electrode into each and connecting them at the orifice. Grossman and I[18] found *in vitro* that the antibacterial effect from a single electrode is greater than that resulting at each of the electrodes constituting the multiple electrode. Clinically, it was found that the treatment time cannot be lowered in electrolyzing simultaneously two canals of a multirooted tooth, or the canals of two teeth, by using two single electrodes connected to two separate electrolyzers. On the basis of Pond and Price's[16] work and Grossman's and mine, it seems necessary to conclude that multiple electrodes should not be used.

4. What should be the position of the active electrode in the canal? Zierler[3] chose an electrode which approximately filled the lumen of the canal and extended nearly to the apical foramen.

14. Sturridge, Ernest: Dental Electro-Therapeutics, Ed. 2, Philadelphia: Lea & Febiger, 1918.

15. La Roche, Montgomery: Relation of Bacteriological Findings to Treatment of Infected Teeth, J. Allied Dent. Soc., 13:155 (June) 1918.

16. Pond, S. E., and Price, W. A.: Electrolytic Medication, J. N. D. A., 5:601-628 (June) 1918.

17. Johnston, H. B.: Pulp Canal Filling and Ionization Results, D. Cosmos, 64:1257-1263, 1326-1334 (disc.) (Dec.) 1922. Footnote 11.

18. Grossman, L. I., and Appleton, J. L. T., Jr.: Experimental and Applied Studies in Electro-Sterilization, D. Cosmos, 73:370 (April) 1931.

Evidently intending to concentrate the action near the tip of the electrode and anticipating the findings of Pond and Price, cited below, Frank D. Price[6] painted the active electrode with collodion to within about one quarter inch of the end to insulate all but the exposed part. This procedure suggests a criticism which repeatedly comes to mind in reviewing much of this literature. A worker has an idea—let us call it a "bright idea" —which seems plausible. He at once puts it into effect without making the slightest effort to determine by actual tests whether it will do what he expects it to do. In this case, it would be extremely easy to learn whether collodion immersed in an electrolyte would act as an insulator. I am indebted to Dr. Grossman for the following tests: All conditions in these experiments were kept constant, except for the presence or absence of a collodion coating.

A. Electrodes coated with collodion and allowed to stand for five hours. (1) heavily coated, 1 m.a. came through; collodion entirely removed, 1.6 m.a. came through; (2) lightly coated, 1 m.a. came through; collodion entirely removed, 2.2 m.a. came through.

B. Electrodes coated with collodion and allowed to stand over night: (1) heavily coated, 0.7 m.a. came through; collodion cleaned off tip for one-eighth inch, 1.3 m.a. came through; collodion entirely removed, 1.5 m.a. came through; (2) lightly coated, 1 m.a. came through; collodion cleaned off tip for three-sixteenths inch, 2 m.a. came through; collodion entirely removed, 2.2 m.a. came through.

It is thus obvious that collodion under these conditions is only a partial insulator. That is aside from what I consider to be the main point. Frank D. Price assumed that collodion was an insulator and immediately acted on this assumption without making any attempt to verify it. This is only one instance of offenses against scientific method which crop out time after time in most of the literature on the use of electromedication in dentistry.

For the treatment of an abscess draining through the canal, Prinz[7] advised that the electrode be thrust through the foramen into the abscess cavity. The following quotation is from Custer[8]: "Do not force the cone (zinc electrode) to apex, for then the principal effect will take place in the apical region. What we now want to do is to sterilize the dentin." This is a curious point of view. It is difficult to understand why anyone would not want the principal effect to take place just in the apical region. Sturridge[12] placed the electrode to within a short distance of the apex. Johnston[11] did not permit the electrode to pass through the canal. Neither must it be farther than three-sixteenths inch from the apex, according to his belief. Stoloff[10] likewise warned against putting the electrode through the apex.

These opinions do not seem to be much more than rather arbitrary personal preferences. The only convincing work which has been done on the question as to where to place the active electrode is that of Pond and Price.[16] An attempt was made, using extracted teeth, to determine whether the ions had free access through the apical foramen and under what conditions the current was conducted from the pulp chamber to the surrounding tissues, particularly the proportion of current passing through the apical foramen to that passing through the lateral walls to the alveolodental periosteum. They found that with the electrode placed to about one-eighth inch from apex, only one-fourth of the total current could pass through the pathologic tissue at the apex and the other three-fourths would probably pass through normal tissues. The farther the point of the electrode from the apex, the less the current passing through

the periapical tissues and the more the current passing through the walls of the root to the lateral (parietal) alveolodental periosteum.

It seems desirable, with the evidence at present available, that the end of the electrode be as near the apex as possible, even to the point of following Prinz (when possible) in thrusting the electrode through the foramen. We must not forget that when the electrode is passed through the foramen (as Pond and Price pointed out), another fact is introduced, the formation of gas. The effect of hydrogen, oxygen and chlorin, when confined in the periapical region, has not been studied carefully.

5. What is the most desirable form for the active electrode? This is a minor point. Zierler[3] advised against using a sharp point. Johnston[11] used a 30-gage wire, flattened and pointed to permit the circulation of the solution.

6. What should be the form of the inactive electrode and where should it be applied? There is little definite reference to these questions in the literature. Some form of hand electrode seems generally to be preferred. Certain writers believe that this electrode should be fixed so that the patient cannot voluntarily or involuntarily break the circuit; and some writers take the opposite view. Custer[8] placed the inactive electrode opposite the root to be treated. One writer, the reference to whose paper I have mislaid, devised an electrode consisting of two small cups (to contain cotton soaked in sodium chlorid solution) fastened together with a spring, to clip over the alveolar process opposite the apical region of the tooth to be treated. One cup would be on the labial or buccal side of the process, the other, on the lingual or palatal side.

7. What electrolyte (or other solution) should be used? This question, after all, is the kernel of the nut. The electric current *per se* is credited with little effect. Substances in solution are expected to do the work. It is consequently a surprising and lamentable fact that so many writers are indefinite or ambiguous on this point. In reading much of the literature, we get the impression that the writer felt he must do something and was following an intuition. It is almost unbelievable, but true nevertheless, that an author can publish anywhere from three or four up to a dozen printed pages on electromedication without making it unmistakably clear what solution he used. It is "Hamlet with Hamlet left out." I cannot but feel that the editors who accepted such material for publication are in part to blame.

The opinion has been expressed that the concentration of the electrolyte in solution is of little matter, that the amount of the current is the dominant factor. Whatever the theoretical basis of this opinion, the fact is that Grossman and I[5] found very appreciable differences in the antibacterial effects of various concentrations even when the amount of current was constant. This does not mean that the amount of current has no effect.[19] Zierler[3] and Prinz[7] used 1 per cent sodium chlorid. Ohngemach[4] used sodium chlorid or silver nitrate. F. D. Price[6] used zinc chlorid with the zinc electrode. He also used "iodin" and "oxygen." Custer[8] used surgical solution of chlorinated soda or alcohol plus sodium chlorid. Fette[20] used about 2 per

19. Grossman, L. I., and Appleton, J. L. T., Jr.: Experimental and Applied Studies in Electro-Sterilization, D. Cosmos, 73:482 (May) 1931.

20. Fette, G. T.: Electrolytic Medication with Special Reference to Ionic Chemistry, J. N. D. A., 5:1033-1047 (Oct.) 1918.

cent zinc chlorid. Sturridge[12] used 3 per cent zinc chlorid. Pincus[21] used zinc chlorid. Sturridge[2] used "iodin" at some times and "zinc" at others. Johnston[22] used Churchill's tincture of iodin; while Stoloff[10] preferred Lugol's solution. La-Roche[15] advocated the following curious mixture: 95 per cent alcohol and distilled water, equal parts, with creosote and boracic acid added to saturation. Possibly even more exotic is the selection of Tritschler[13]: silver nitrate, colloidal silver and mercury (1:1), silver citrate, and "iothion."

In the foregoing summary, we see empiricism, in its less flattering sense, run wild. Not a single report contains a mention of a control or of comparative studies to determine the relative advantages of the several solutions. Before we can know whether electromedication is better than some other form of treatment, a numerically adequate number of cases must be treated by each method and the results compared. Before we can know whether one solution is better than another, a numerically adequate number of cases must be treated by each method and the results compared. This holds not only for the solution but also for all the other various factors, such as the material of which the active electrode is composed and whether the positive or the negative pole was used. We raise this criticism specifically now because selection of the solution is of such obvious and outstanding importance.

To make valid comparisons between substances in solution, it should be axiomatic that chemical equivalents shall be the basis of the concentrations. To take the simplest example, one does not compare 1 per cent hydrochloric acid with 1 per cent sodium hydroxid. One compares a solution containing 36 gm. (or some multiple thereof) of hydrochloric acid per liter with a solution containing 40 gm. (or some multiple thereof) of sodium hydroxid per liter. These are called molar solutions. They are obviously indicated in work with electrolytes. Pond and Price[16] advocated them, and Grossman and I[23] used them wherever possible.

In this work, which was exclusively *in vitro,* we employed about fifty different solutions of substances which had been recommended for electromedication or which for various reasons seemed to hold out some promise. From hundreds of tests, we definitely proved (1) that greater antibacterial effect was uniformly obtained from an electrolyzed chemical solution than from the same solution without electrolysis and (2) that the solution of greatest antibacterial effect (when electrolyzed), compatible with tissue tolerance, is a solution of zinc iodid (1 mol.) plus iodin (0.1 mol.). So far, the clinical work with this solution has proved satisfactory. Dr. Werther[24] of the operative clinic of the School of Dentistry, University of Pennsylvania, has collected clinical evidence which indicates that the antibacterial effects of this solution, electrolyzed, is superior to the antibacterial effect of camphorated monochlorophenol, topically applied on a dressing sealed in the canal. Dr. Grossman, likewise working on human beings, has evidence that the antibacterial effect of 1 per cent sodium chlorid, electrolyzed, is superior to the antibacterial effect of camphorated monochlorophenol, topically applied on

21. Pincus, Cecil: Case Reports of Non-Surgical Treatment of Rarefied Areas at Apices of Pulpless Teeth, Australian J. Dent., 29:392-396 (Nov. 1) 1925.

22. Footnote 17, first reference.

23. Footnotes 1, 5, 18 and 19.

24. Werther, Raymond: D. Cosmos, 74: 328 (April) 1932.

a dressing sealed in the canal. The average number of treatments necessary to get a negative culture via the root canal, for twenty-three cases treated with monochlorophenol was five; while the average number for thirty-one cases treated with 1 per cent sodium chlorid, electrolyzed, was three. This is only a beginning, but it illustrates the lines along which research must follow if we are going to decide intelligently which method of treating periapical infection is best.

The reasons advanced for the several solutions advocated are for the most part based on deductions unsupported by direct appeal to the facts. In my notes, time after time, I find the remark at the bottom of my abstract: "No case histories, no bacteriologic or x-ray checks on cases treated." (C. G. Ohngemach[4]; Sturridge[12]; Custer[8]; Stoloff[10]; Pincus.[21]) To all writers, the chief objective is to secure sterility of the tooth substance or of the periapical tissues or both. This may be secured directly or indirectly; i.e., by means of the tissue reaction.

Stoloff[10] chose an electrolyte containing iodin (Lugol's) for (1) the germicidal effect and (2) the physiologic effect.

1. Iodin increases the permeability of the vessel walls. It produces typical fibrinous inflammation of the serous membranes. After the destruction of their epithelial coat, these serous membranes show a pronounced tendency to adhere and therefore to heal by first intention. For this reason, iodin is successfully employed in the treatment of fistulous tracts. Incidentally, it enlarges the walls of the various vessels, promotes absorption, and by reflex action produces hyperemia, which involved all the tissues within the affected area.

2. By inducing a local hyperemia, an increase of phagocytosis takes place, and inflammatory byproducts of the pathologic processes are digested. The field is thus prepared for the normal reconstructive processes.

All this apparently is built on *a priori* reasoning. Stoloff offers no experimental or histologic evidence in support of the foregoing assertions.

Justina Wilson,[25] in an interesting paper which does not specifically touch on oral diseases, asserts that the galvanic current affords unfailing relief from pain, swelling and tension, while its nutritional effect is unrivaled. A hyperemia is often said to be a result of electromedication. Later on, we shall resume and extend this discussion of the mechanism by which electromedication may act. In brief, we agree with Pond and Price.[16] The situation has not materially changed since they wrote: "Much more careful clinical and (other) laboratory data must be advanced to determine whether specific ions will penetrate and disinfect periapical tissues under definite conditions."

8. What strength of current is optimum? 9. How long should the current be applied? 10. How many treatments are necessary? 11. What is the optimum interval between treatments?

These four questions are closely related and must be discussed together.

A fundamental relation between the strength of current and the time during which it acts, as judged by the resulting antibacterial effect, was established by Grossman and me.[19] Zinc iodid (1 mol.) plus iodin (0.1 mol.) was the electrolyte. The relation was an inverse one. For a constant quantity of electricity, regardless of the variations in current strength and in time, other things being equal, a constant antibacterial effect will result.

Working with extracted teeth, Zierler[3] found that the employment of 3 to 3.5 m.a. for ten minutes sufficed to sterilize the contents of the root canal, even when

25. Wilson, Justina: Some Uses of Galvanic Current in Therapy, Brit. J. Phys. Med., 6:115-117 (Sept.) 1931.

endospores were present. From this, he developed the well-known formula $\frac{30}{\text{m.a.}} = t$ (time in minutes); i.e., dividing 30 by the number of milliamperes that the patient tolerates gives the number of minutes required for treatment. Extending this finding to his clinical cases, Zierler found that attempts to use less than 30 m.a. minutes were unsuccessful. He stated that from at least 35 to 40 volts was necessary. The canal was to be filled immediately after one application of 30 m.a. minutes. If, for any reason, less than that is given at one sitting, it is best to repeat before filling the canal.

Frank D. Price[6] reported that a current of 3 m.a. for fifteen minutes will sterilize a root and surrounding tissues as no retained medicament ordinarily can. No evidence is offered for this statement. Six case histories are briefly given that tell nothing but that the patient was satisfied. The voltage is stated to have been 16 to 24 volts.

Prinz,[7] using a current of from 30 to 40 volts, verified Zierler's formula. There should be an interval of forty-eight hours between the first and second treatments. If necessary, a third treatment might be given on the fifth day. No reason is given for this timing. A canal should never be filled immediately after the first treatment. An interval of at least twenty-four hours should be allowed before doing so.

In the majority of cases, La Roche[9] used 0.2 m.a. for fifteen minutes. Usually, four treatments sufficed. He routinely checked each clinical case bacteriologically and would not fill a canal unless a negative culture was obtained. His cultural method seems to have been very rigid. Johnston[22] intimated that he used 0.5 m.a. for thirty minutes, filling the canals immediately. He checked his work bacteriologically. We shall take this up later. Custer[8] adopted Zierler's formula. Rhein[26] wrote:

> . . . it took exactly 45 m.a. minutes before the streptococcus was absolutely annihilated [on the authority of Sharpe of Pasadena, Calif.] . . . we are using a straight voltage of 110 volts, it was found that not more than 1 m.a. of current could be passed through the end of a root. . . . it is a rare thing that you can get more than 2 or 3 m.a. of current through a tooth.

Fette[20] adopted Zierler's formula:

> Three milliamperes is about the maximum (tolerated by the patient). I hardly go above 2 when I pass the current through the apex of a tooth. We may pass 2 m.a. of current for 15 minutes independent of the area of the electrodes in the tooth.

Stoloff[10] made the following recommendations: A tooth which has been freshly devitalized and in which there is no evidence of putrescence, is given two treatments of at least fifteen minutes each, with an interval of at least forty-eight hours. The canal is filled immediately after the second "ionization." Putrescent teeth are given at least three "ionizations," of at least fifteen minutes' duration. He found in 100 "ionization" treatments, a range of tolerance from 0.1 to 2.2 m.a. The readings in fifty cases in males showed an average of 0.798 m.a.; 21.4 volts, requiring a period of 15.09 minutes. The readings in fifty cases in females showed an average of 0.720 m.a.; 17.06 volts, requiring 16.03 minutes. The period of time needed was arbitrarily taken to be the time required to decolorize entirely Lugol's solution. Stoloff's report is documented by no case histories, no bacteriologic tests and no roentgen-ray examinations.

The following notes are taken from

26. Rhein, M. L.: Disc. of Fette, G. T.: Electrolytic Medication with Special Reference to Ionic Chemistry, J. N. D. A., 5:1041 (Oct.) 1918.

Tritschler's paper: Case 2, 0.5 m.a. for fifteen minutes; Case 3, 0.5 m.a. for twenty minutes; Case 4, 0.3 m.a. for fifteen minutes. Ohngemach[4] adopted Zierler's formula, usually employing 0.5 to 2.5 m.a., at two sittings, with an interval of from three to five days.

Zierler's formula was also adopted by Sturridge.[12] He found the range of tolerance to be 1.5 to 5 m.a. The canal was filled immediately.

The following notes are from the paper by Pincus[21]: Case A, 1 m.a. for ten minutes, repeated three days later; Case B, 1 m.a. for thirty minutes, repeated one week later; Case C, 1.5 m.a. for twenty minutes.

I have asked four questions: What strength of current is optimum? How long should the current be applied? How many treatments are necessary? What is the optimum interval between treatments? You will agree that these are important questions. They must be faced by the operator every time a patient comes in for electromedication; and yet, from the printed evidence which I have just summarized, not a single one can today be answered satisfactorily. We probably know pretty well the range of tolerance for most patients; but, for the rest, we might as well build a foundation on quicksand as plan a rational therapy on the data available.

In going over the literature on the use of electromedication in the treatment of periapical infection, one reaches the conclusion that its advocates expressly or implicitly claim that it sterilizes the dental and the periapical tissues. This may be accomplished directly or indirectly. By "directly," I mean that the chemical products of electromedication are in themselves germicidal. By "indirectly," I mean that the chemical products of electromedication either so lower the vitality of the bacteria that they become an easy prey to the body defenses or these body defenses (e.g., phagocytes) are so stimulated or increased that they readily destroy the bacteria. It is unlikely that such antibacterial effects as electromedication may exert are attributable to the heat generated. (W. A. Price[27]; Grossman and Appleton.[28])

Frequently, experiments have tended to show that a solution penetrates dentin more deeply or more rapidly under the influence of a direct current than when left to the ordinary processes of diffusion. Such results have been interpreted as indicating that a direct current enhances the antibacterial effect of the solution. For instance, Prinz[7] reported on the penetration of silver nitrate and of potassium ferrocyanid; Tritschler,[13] on the penetration of potassium iodid, anilin blue, phenolphthalein, alcoholic eosin and collargol, and Bödecker,[29] on the penetration of safranin and of Gram's gentian violet. All such experiments are open to the criticism that their results hold only for the solutions employed. It is not permissible to assume that other solutions, such as those used clinically in this field, would behave similarly. *In vitro* tests by Pond and Price[16] indicated that the tooth was impermeable to zinc and iodid ions.

The direct and obvious way to determine the depth of penetration into dentin, as far as it is bactericidally effective, is to treat a tooth (which had a gangrenous pulp) *in situ* and then, after extraction, take specimens for bacteriologic examination, at various depths from the surface of the canal. In fact, when

27. Price, W. A.: D. Items of Int., 20:489 (May) 1898.

28. Footnote 5, p. 156.

29. Bödecker, C. F.: Ionization of Septic Roots, Tr. D. Soc., New York, 1927, pp. 90-97.

Prinz[7] did this after electrolyzing 1 per cent sodium chlorid, he found the sterilizing effect to be most superficial. Similar experiments should be made with other solutions for various quantities of current.

Turning from the question of the sterilization of the dentin to that of the sterilization of the infected periapical tissues, we find the most interesting *in vitro* tests to be those reported by Johnston.[17]

> The first series of experiments closely approximating clinical conditions consisted of obtaining freshly extracted teeth which had come out with granuloma intact on the root ends. The specimen was immediately sent to the bacteriologist, cultures taken from the canal and from the granuloma, returning it immediately to me. I then put a wax collar around the gingival portion of the tooth, immersed the root portion in a tube containing Ringer's solution and having an electrode embedded through the glass bottom of the tube. The canal was then opened and cleaned out mechanically, the electrolyte pumped into the canal until contact was obtained with the granulomatous tissue, a platinum electrode passed into the canal, electrical connection made and the desired flow of current passed through it. Immediately upon completion of this treatment, the tooth was returned in the tube to the bacteriologist, who removed it, picked off the granuloma, macerated it, chipped off the apical third of the root, pulverized that, and both specimens were cultured. . . . After a considerable number of such experiments, I found that if I used Churchill's tincture of iodin, giving 0.5 m.a. of current and continuing it for 30 minutes, I could sterilize the entire tooth structure and the largest granuloma I had obtained.

Up to this point, I have tried chiefly to present a summary of the actual practice of electromedication; definite, specific, technical points needed for its clinical application. It is true that I have not strictly limited myself to reporting what others have done or said that they have done. I have now and then expressed an opinion. But that was all in passing. From now on, I intend to exercise deliberately what critical judgment I may possess.

Why is it sometimes advised that a pulpless tooth be extracted? To eliminate (or to forestall the development of) periapical infection, out of respect for the general health of the patient.

Why does the dentist attempt to retain a pulpless tooth? For function, for cosmetic reasons, or to simplify the solution of some prosthetic problem.

These two questions and their answers sometimes conflict.

Considering both sides and harmonizing the conflicting objectives, we have the following statement: A pulpless tooth may be retained if its periapical tissues can be rendered sterile and if these periapical tissues can be restored to, and maintained in, a state in which their resistance to hematogenous or lymphogenous infection is normal.

The next logical step seems to be to determine whether or not a proposed method of treatment satisfies these conditions. What are the criteria by which the efficiency of a method advocated may be judged?

As an answer, I propose the following:

1. Is the tooth rendered or maintained subjectively comfortable to the patient?
2. Is Hinman's sign of periapical involvement absent?
3. Is there an amelioration of extraoral symptoms of focal infection, or do these symptoms disappear?
4. Is there roentgenographic evidence that the periapical tissues have returned to normal?
5. Is there histologic evidence that infection is absent from the periapical tissues, that these tissues have normally regenerated or that satisfactory repair has taken place?
6. Can negative cultures (of course, with appropriate technic) be obtained

via the root canals? Other things being equal, the fewer the treatments needed to secure negative cultures, the better the treatment.

7. Were negative cultures obtained from the periapical region on root amputation or by the Coriell trocar? In answering this question, it is especially desirable to choose teeth whose full history, clinical, roentgen-ray, etc., is on record. How long after treatment were such negative cultures obtained?

8. Were negative cultures from the periapical region obtained from teeth extracted for experimental, prosthetic or orthodontic reasons? Here likewise, a full history, clinical, roentgen-ray, etc., is desirable. How long after treatment were such negative cultures obtained?

There may be other criteria. I do not suppose the foregoing list is complete. For the present, let us take the ones we have mentioned and let us see how far they have been applied by the various advocates of electromedication. In this part of the paper, we shall consider only clinical evidence.

1. Is the tooth rendered or maintained subjectively comfortable to the patient? All the publications reviewed have explicitly or by implication answered "Yes." Most of them have gone no farther. Apparently, if the patient was satisfied, why worry? There is no evidence, outside of impressionistic opinions, that electromedication is better in this particular than other forms of treatment, or that one form of electromedication is better than another.

2. Is Hinman's sign of periapical involvement absent? Johnston[17] is the only one who mentioned this symptom. He noted that it disappeared following his treatment (electrolysis of Churchill's iodin).

3. Is there an amelioration of extraoral symptoms? Adequate data on this point would be quite important. Unfortunately, almost no definite reference is made to it. In case A, reported by Pincus,[21] neuritic pains in the left arm disappeared after treatment.

4. Is there roentgenographic evidence that the periapical tissues have returned to normal? Most of the writers gave an affirmative answer to this question. It does seem logical to require roentgenographic evidence of regeneration before approving any proposed method, but it is important to realize that this type of evidence alone is not enough. The assumption that periapical regeneration as shown by the roentgen-rays is incompatible with the presence of bacteria is purely gratuitous and is not supported by the facts. Haden[30] obtained bacterial growth from the periapical region of about 55 per cent of a large number of roentgen-ray negative pulpless teeth. In a similar series of fifty teeth, Austin and Cook[31] obtained growth in 84 per cent. There is no reported evidence that regeneration of rarefied areas, as judged by roentgen-ray examination, results in a higher percentage of cases when electromedication is used than when some other form of treatment is followed; that the regeneration occurs more rapidly; that the regeneration lasts longer, or that there are fewer cases which show an eventual breaking-down after an initial regeneration. Drs. Grossman and Werther are at present engaged in collecting data of this sort.

5. Is there histologic evidence that infection is absent from the periapical tissues, that these tissues have normally re-

30. Haden, R. L.: D. Cosmos, 67:380-384 (April) 1925; Bacteriology of Chronic Periapical Dental Infection, J. A. D. A., 13:1370-1383 (Oct.) 1926.

31. Austin, L. T., and Cook, T. J.: Bacteriologic Study of Normal Vital Teeth, J. A. D. A., 16:894 (May) 1929.

generated or that satisfactory repair has taken place? This type of evidence is especially desired and yet I have found only one instance in which an effort was made to collect it. Here seems to lie a particularly suitable field for preliminary animal experimentation.

According to Cahn,[32] teeth showing apical rarefactions were treated by electromedication and then, after a definite lapse of time, the apical mass and apex were removed. It was uniformly noted that the granulomatous tissue was undergoing marked changes and that coagulation necrosis was a frequent characteristic. Apparently, the current acted as a tissue coagulant and caustic. Some details of one case, treated with Churchill's iodin electrolytically, three times, are given. One year after filling, there was no roentgenographic evidence of regeneration of the periapical tissues. The tooth was extracted. Apically, there was a mass of fibrous tissue. It did not resemble a granuloma, being almost entirely devoid of inflammatory round cells. No bacteriologic examination was made.

6. Can negative cultures be obtained *via* the root canals before filling the canals? I have insisted that no canal should be filled while a positive culture can be obtained from the canals, an effort being made to secure a fair sample of the periapical exudate for the material to be cultured.[33] This was insisted on, on general principles. Recently, in going over data of Rhein, Krasnow and Gies,[34] I have found direct evidence supporting this view.[35] In the light of what we know of focal infection, it does not seem justifiable to seal a canal while there is evidence that bacteria persist in the periapical tissues. If bacteria survive while the natural defensive forces of the body are reinforced by drainage and antiseptics, it does not seem likely that they will generally succumb when we trust to the natural defensive forces alone. I admit that this is an opinion, but, for the present, the burden of proof that the sealing of the canal while bacteria are known to persist in the periapical tissues is justifiable rests with those who sanction this practice. The clinical data collected by Pond and Price[16] included the culturing of the fluid from the periapical area in a large number of cases, including immediate aspiration, one hour, one day and several days after, electrolytic medication. In each and every case, they obtained vital cultures. No protocol or details are given. Such a record is worthless for our present purposes.

Prinz[7] mentions five experiments on teeth in the mouths of patients (with 1 per cent sodium chlorid electrolyzed). Apparently, no bacterial growth was obtained after treatment. In doubtful cases, he says, sterility should be verified by a bacteriologic test. All cases, I contend, are doubtful cases.

In a discussion of this subject, Rhein[26] said:

> . . . whether we call it ionization or electrolyzation, it matters little, but it is sufficient to eliminate the pathogenic condition . . . and the bacteria themselves . . . we have found it impossible to get cultures from the periapical region through the ends of the roots of teeth where we formerly obtained them.

32. Cahn, L. R.: Electrolytic Medication, Tr. D. Soc., New York, 1928, pp. 79-82.

33. Appleton, J. L. T., Jr.: Bacteriologic Control of Treatment of Periapical Infection, D. Items Int., 49:589 (Aug.) 1927.

34. Rhein, M. L.; Krasnow, Frances, and Gies, W. J.: Prolonged Study of Electrolytic Treatment of Dental Focal Infection—Preliminary Report, D. Cosmos, 68:971-981 (Oct.) 1096-1102 (disc.) (Nov.) 1926.

35. Appleton, J. L. T., Jr.: D. Cosmos, to be published.

As no details of the method, not even of the electrolyte, are given, this report helps us little, beyond giving some encouragement. A later study, by Rhein, Krasnow and Gies,[34] is one of the most important contributions to the subject. Its value is not what it should have been because no details of the method of electromedication are given and there is no reference given as to where we might find those details. Rhein routinely cultured all canals before filling, but he rather frequently filled them in the presence of a positive culture.

The following quotation from Rhein is interesting because it reflects a widely held opinion:

> A great many dentists have been unduly frightened by reports of organisms being found in some cases of regenerated alveolar process. As we are now constantly finding such bacteria not only in freshly exposed pulps, apparently healthy, but also in the periapical region of teeth with living pulps, such fears are groundless.

Bacteria may be cultured from the periapical region of teeth with vital pulps, when these teeth or their neighbors are involved in a gingivitis or pyorrhea. Also, I would not be surprised to find bacteria in the periapical region of teeth with deep-seated dental caries, even though the pulp was clinically in a good condition. Likewise, I would not be surprised to find bacteria in the periapical region of teeth with normal pulps, if the teeth were in proximity to a periapically infected neighbor or to an infected maxillary sinus or when tonsilitis was present. Finally, I do not forget the difficulty of getting cultures from the periapical region of extracted teeth, without contamination. These conditions might go a long way in accounting for the finding of bacteria in the periapical region of teeth with "normal" vital pulps. They would have to be eliminated before one should regard the finding of bacteria in the periapical region of a pulpless tooth as of negligible significance.

Here again, I should like to refer to the work of Austin and Cook.[31] Of 100 clinically normal vital teeth the periapical region of which was examined bacteriologically, growth was obtained in only four; while from 100 pulpless teeth, growth was obtained in eighty-nine. When Haden's method of quantitatively estimating the infection was used, the differences between the teeth with vital pulps and pulpless teeth were greater still. While not denying that occasionally bacteria may be found in the periapical region of teeth with normal vital pulps, the normal condition seems to be sterility.

Rhein and his co-workers made another observation of interest. Their Tables III and IV "demonstrate beyond question the fact that no growth has generally been found immediately after this treatment (electromedication), but that upon the return of the patient at a later period, some form of cocci was found to be present." Johnston[17] made the same observation. Various explanations could be offered for this finding, but at present they would be beside the point. This finding means that a number of successive negative cultures, preferably after nonmedicated dressings have been left in the canal, should be obtained before the canal is finally filled.

In the analysis of some of Rhein's data (which I have made and which is now in press),[35] it was found that the number of failures as determined clinically and by roentgen-rays, in teeth whose canals were filled before a negative culture was obtained was more than twice as great as the number of failures occurring in teeth whose canals were filled only after a negative culture was obtained.

LaRoche[15] continued treatment until a negative culture was obtained.

Johnston[11] routinely took cultures by aspirating a sample of the periapical exudate and did not fill until a negative culture was obtained. In about 100 unselected cases, the results were uniformly negative; i. e., no growth in the cultures. Like Rhein and his co-workers, he noted that a second culture taken after a negative culture was likely to show growth. According to his belief, this is due to the bacteria's having been sucked out of the lymphatics extending to the gingival margin.

As has already been mentioned, Dr. Grossman found that fewer treatments were needed to obtain a negative culture when 1 per cent sodium chlorid (electrolyzed) was used than when camphorated monochlorophenal was topically sealed into the canal. Likewise, Dr. Werther found that fewer treatments were needed to obtain negative cultures when zinc-iodid-iodin (electrolyzed) was used than when camphorated monochlorophenol was topically sealed in the canal. Using the number of treatments needed to get a negative culture as a criterion, Rhein's data show no significant difference between "iodin electrolysis" and "zinc electrolysis." Other things being equal (of course, they have not yet been proved equal), that form of treatment which requires the fewest sittings is the treatment of choice.

7. Were negative cultures obtained from the periapical region on root amputation or by the Coriell trocar? Dr. Grossman has been collecting data to answer this question. A preliminary study has been published to determine the feasibility of this method (Grossman and Prinz).[1] At present, he is standardizing or "calibrating" this method. We do know that negative cultures are sometimes obtained in this way from periapical tissues, known to be infected; and, consequently, the percentage of cases in which this happens must be known before we can use this method to check treated cases. Data of this sort are accumulated very slowly.

8. Were negative cultures from the periapical region obtained from teeth extracted for experimental, prosthetic or orthodontic reasons? I have seen but one report which might come under this heading. The text is not clear. Pond and Price[16] apparently treated a periapically infected tooth for thirty minutes with 4 m.a. After extraction, the root apex and the periapical tissues were cultured, and growth was obtained. Contamination must be avoided, or allowance made for it.

In looking back over these eight criteria, we see that only two (those referring (1) to the subjective comfort of the patient and (2) to the roentgenographic check) have been regularly applied to evaluating electromedication in periapical infection. You will not, I hope, think that I have unduly stressed the need for bacteriologic checking up. I realized that that might be expected of me and have tried to see the problem in a true perspective. After all, periapical infection (and, potentially, the pulpless tooth) is a problem because of the presence of bacteria, because of the danger inherent in their presence and because of the difficulty or impossibility of removing them and avoiding reinfection.

I believe that electromedication offers the most promising method at present in sight for the treatment of the pulpless tooth (if we except root amputation); but, judging from the evidence offered by its advocates (as far as I have been able to find and to digest and to present it to you) for its efficiency, the only verdict

justifiable seems to be the old Scottish verdict, "not proven"; a verdict not very complimentary to the character of the defendant. I know of no method of medicinally treating a pulpless tooth which can be routinely relied on to reduce to a negligible minimum the hazard which the retention of such a tooth offers to the general health of the patient. Before we can be satisfied that we have such a method in our grasp, its clinical results must be weighed in the balance and not found wanting.

The methodologic needs which have been emphasized by this review follow:

1. The technic followed must be explicitly set forth in the minutest detail.
2. We should never draw on an assumption when it is possible to appeal directly to the facts.
3. Carefully taken case histories, recording the findings and exactly what was done, are indispensable.
4. Numerically adequate control and comparative series of cases must be had.
5. Results must be checked up clinically (local and general), roentgenographically, histologically and bacteriologically. The report must be documented adequately with the results of this checking up.

CONCLUSION

I am perfectly willing for the moment to admit that any or all methods of managing the pulpless tooth leave nothing to be desired; that they accomplish all they are intended to accomplish. But we do not know whether this goal has been reached. We may be on the right track or we may have arrived, but we do not *know,* and we cannot know, unless and until the principles outlined in this review (and possibly other principles) have been applied.

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THE PROBLEM OF ROOT CANAL TREATMENT

By BÁLINT ORBÁN, M.D., Vienna, Austria

IT was a great pleasure to read in the May issue of THE JOURNAL the symposium on root canal work by Skillen, Rickert, Hatton, Coolidge, Walker, Adams and Blayney, presenting the opinion of some of the leaders in root canal work in the United States, as well as some of the most widely known research men. We can see in these papers the honest and consistent effort of these men to find the best way to combat this problem.

The Fédération Dentaire Internationale, recognizing the fact that dentistry, as a part of the profession of medicine, is in an untenable position owing to its failure to solve the problem of root canal treatment, determined some time ago to make an effort to clear up this question. Assuredly, not all of the 100 or 1,000 procedures described in the dental literature as the best methods of root canal treatment could be in fact the best, as we know very well that, in root canal work, we have failures enough. It becomes the duty of the dental profession to solve this problem in order to relieve itself of a burden of responsibility and thus strengthen its position of authority in the eyes of both the medical profession and the public.

Before this work could be undertaken, a number of preliminary problems had to be solved. How could a body like the F. D. I. initiate efforts at solution of this

problem? As a rule, if a private individual or a group wishes to launch a project, funds must be available; but this is not all: it is perhaps more important to know how to use the money. This was a matter of discussion by the F. D. I. There are two ways to make use of money in an effort at solution of a definite problem: (1) to finance the efforts of certain research men working independently or in a laboratory and wait to see whether they will be successful; or (2) to turn the funds over to a group like the F. D. I., which will judge the results obtained by various research workers or laboratories and make the award accordingly. The men or laboratories solving the problem will thus receive the financial reward and the honor. Under the first plan, the laboratories or individuals would receive the money and no one could foretell whether they would succeed. In a few years, it might become evident that the entire fund had been spent without result. Under the other plan, there is competition and the award goes only to those who succeed.

Appreciating that public funds should be used most carefully, the F. D. I. adopted the second plan, inviting competition. It should be emphasized that this procedure is adapted only to the solution of a definite problem and not to the promotion of research in general.

The next step was to decide on a method by which the different modes of canal treatment could be evaluated. This was the most difficult phase of the entire problem, requiring the time between the congress in Philadelphia and that in Paris for a decision. Therefore, it was not until the Paris meeting that the international commission, appointed for that purpose, determined on the procedure for controlling methods of root canal treatment.[1] The text of the plan adopted has been published.[2]

The conclusions of Dr. Coolidge in the above-mentioned symposium may seem out of harmony with the premises on which experimentation in the F. D. I. contest is to be based. Coolidge found that after the use of neutral physiologic sodium chlorid, an inflammatory reaction occurred in the periodontal membrane of dogs' teeth, and, after the use of more active drugs, the inflammatory reaction was more severe. He, as well as Dr. Blayney, drew the conclusion that we cannot expect the same results in practical root canal treatment in human beings as in an experiment with dogs. This is not a conclusion drawn from experiment, but is an opinion of these men not supported by actual observation. No one has up to date observed how sodium chlorid would act in a human tooth in twenty-one days, and therefore no one in entitled to draw from an experimental result in dogs the conclusion that in human beings the result would be different.

It was clearly demonstrated and accepted in Paris that the periapical tissues of dogs' teeth are very sensitive to any kind of injury. It seems that they are in fact more sensitive than human tissues. It was suggested at that time that a part of this hypersensitiveness is due to the fact that there is greater permeability of the hard structures of the teeth, dentin and cementum than in human beings. These structures in dogs seem to permit the penetration of drugs more readily into the periapical tissues than is the case in

1. This commission consisted of J. L. T. Appleton, Jr., P. Bernard, E. D. Coolidge, Bernhard Gottlieb, O. Muller, Bálint Orbán, W. A. Price, U. G. Rickert and Georges Stein.

2. F. D. I. Competition in Root Canal Work: Method for Verification of Root Canal Treatment, J.A.D.A., 19:356 (Feb.) 1932.

human teeth. This difference in density of the structures could be observed in various experiments. Nevertheless, it has been shown that, in experimental root canal work, one can observe periapical tissue showing no inflammatory reaction, not only after extraction of an intact pulp, but also after treatment of an infected root canal with periapical inflammation.

cepted as constituting a fair and satisfactory test. If treatment in the more sensitive dog proves satisfactory, it can be expected to be still more acceptable in human beings. In Paris, we showed slides of periapical tissues after pulp extraction as well as pulp infection without inflammation.[3] A few additional apices presenting pathologic reactions are shown here;

Fig. 1.—Apex of dog's tooth, with pulp extirpated and root canal treated. The apical periodontal tissues are entirely free from inflammatory reaction. The dog was killed about eight months after filling of the root canal.

Evaluation of root canal treatment is difficult but is possible. The greater sensitiveness of the dog's tissues adds to the difficulty; but this is a welcomed fact, since if it can be shown that in dogs satisfactory root canal treatment is possible, experiments on the dog have to be accepted not to recommend a certain procedure in root canal surgery, but to show that in experimental work the value of a method can be proved. (Figs. 1-4.)

3. Gottlieb, Bernhard; Orbán, Bálint, and Stein, Georges: Das Problem der Wurzelhandlung, Ztschr. f. Stomatol., 1932, No. 4.

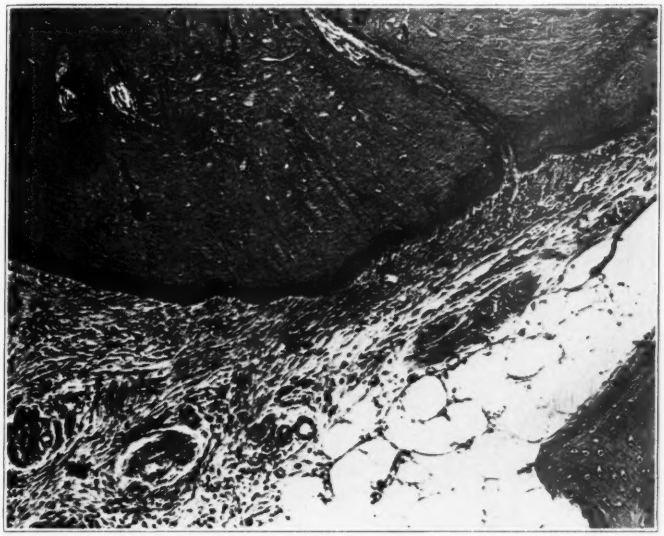

Fig. 2.—Higher magnification of a canal branch from Figure 1. The periapical tissues are free from inflammatory reaction.

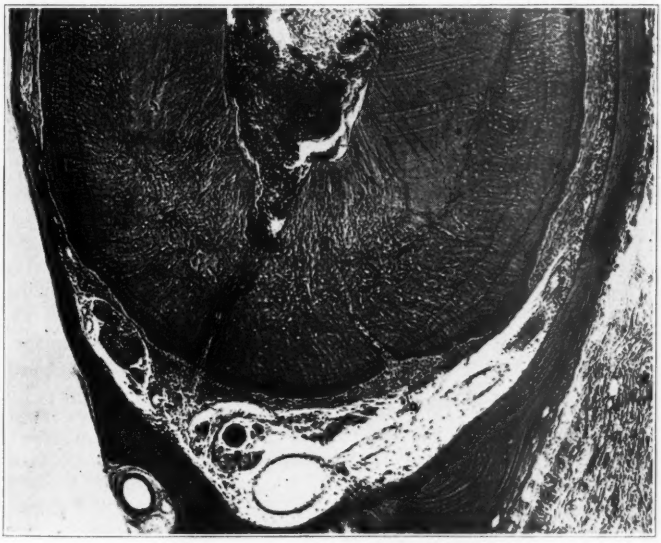

Fig. 3.—Apex of dog's tooth treated and filled. The periapical tissues are normal and there is no inflammatory reaction. The dog was killed eight months after treatment.

The profession seems to be tired of so-called satisfactory methods set forth without proof. This reaction of the profession, which can be seen in the papers making up the above-mentioned symposium, can be regarded as a forward step, promising much for the future.

Of course, we do not expect from this contest an immediate solution of the root canal problem, and we can hardly expect that one and only one method of root canal surgery will be found to be "the best." It will be a great achievement if we determine what has *not* to be done, and if about 90 per cent of all methods regarded today as the "best" shall be discarded. A great advantage will accrue to the profession if only about 10 per cent of the former methods are employed, and we can then go a step farther and try to so reduce these methods in number that root canal surgery shall become standardized.

Fig. 4.—Higher magnification of the periapical tissue shown in Figure 3. There is no inflammation of the tissues.

The work that the F. D. I. has undertaken suggests and bears a resemblance to the work that is being done by the Bureau of Standards.

All who are interested in the solution of this problem should collaborate in and give this work their support.

EXPERIMENTAL DENTAL GRANULOMAS IN DOGS*

By THOMAS J. HILL, D.D.S., Cleveland, Ohio

THE experiments here detailed were conducted, first, to observe whether dental granulomas produced experimentally in dogs were comparable to human dental granulomas; and, secondly, to compare the development of granulomas when the root canals have been infected with that of granulomas adjacent to sterile pulpless, unfilled roots. It is evident that the recovery of bacteria from mature granulomas does not prove their etiologic relationship because bacteria may be present as the result of secondary invasion of necrotic tissue.

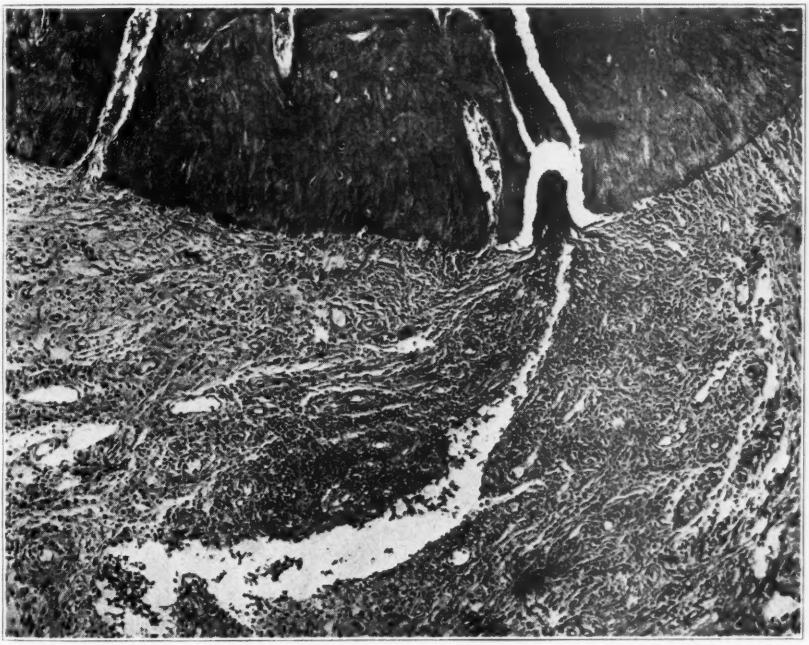

Fig. 1.—Appearance of section twelve days after removal of pulp and infection of canal with streptococci.

*From the Institute of Pathology, Western Reserve University.

*Work aided by a grant from the Callahan Memorial Award Commission.

*Read before the Section on Research and Biologic Sciences at the Midwinter Clinic of the Chicago Dental Society, Jan. 19, 1932.

Gottlieb, Schwarz and Stein[1] and Boulger[2] have studied the tissue reaction which occurs when root tips have been implanted in the muscles of rats. These workers have demonstrated quite clearly that the tissue reaction in the presence of infected roots is different from the reaction in the presence of implanted, uninfected teeth. These conditions are not similar to those present when the same teeth are *in situ*. While, in a general way, it may be said that all inflammatory tissue reactions have a certain similarity, it cannot be assumed that the reaction of muscle to the presence of a foreign body would be the same as the reaction of the peridental tissues if the same teeth were in the normal position, i.e., in their alveolar sockets. In the implantation of root tips in animals, there is necessarily a loss of the peridental membrane and its attending structures. Attention has been called to the importance of epithelial rests in the peridental membrane and their part in the formation of cysts. In this respect, cystic areas that develop when root tips are implanted in the muscles of rats are not identical with the cystic areas that develop at the apex of teeth in the alveolar bone.

Fig. 2.—Section of tooth twelve days after sterile pulp removal.

1. Gottlieb, Bernhard; Schwarz, A. M., and Stein, Georges: Das Problem der Wurzelbehandlung, Ztschr. f. Stomatol, 26:1151, 1928.

2. Boulger, E. P.: Reaction of Rat Tissue to Implanted Root Ends, J.A.D.A., 18:988 (June) 1931.

The conditions present in the development of dental granulomas in dogs approximate, but are not exactly like, the conditions present in human dental granulomas. The number of foramina in dogs' teeth is greater and the branching of canals occurs higher in the pulp chamber than in the average human tooth. These anatomic features may account for the fact that dental granulomas are produced more quickly and more easily in dogs than in human beings.

The work here reported was conducted on forty-eight teeth in the mouths of dogs. The cuspid teeth were not used because their length prevented proper removal of pulps with standard root canal instruments. A few cuspid teeth from which pulps had been removed frequently showed fragments of the odontoblasts adhering to the dentinal wall.

The second or third incisor teeth, upper and lower, were used. The pulps were removed from the teeth and the dogs were killed on a schedule that would allow the study, in chronologic order, of these teeth from the primary injury to the mature granulomas.

Fig. 3.—Section of tooth four weeks after sterile pulp removal.

The anesthetics were ether or morphin and scopolamin. When morphin and scopolamin were employed, the dosage suggested by Noyes[3] was used and a very satisfactory anesthetic was produced.

3. Noyes, F. B., and Ladd, R. L.: Lymphatics of Dental Region, D. Cosmos, 71:1041 (Nov.) 1929.

All teeth were operated on under as strictly aseptic conditions as it was possible to obtain. In one series, the pulps were removed and the root canals were left unfilled, but the coronal ends were hermetically sealed with cement and amalgam. In another series, the pulps were removed and dressings consisting of sterilized paper points infected with pure cultures of streptococci were inserted. These teeth were also sealed at the crowns with cement and amalgam.

Two strains of streptococci isolated from two granulomas removed from a hospitalized tuberculous patient were used. One strain was a small, short chain, *Streptococcus hemolyticus;* the other strain was a larger chain, nonhemolytic streptococcus.

All teeth treated, either by infection of the root canal or by sterile removal of the pulp, developed granulomas if allowed to remain for a sufficient length of time. The teeth which were infected showed inflammatory reaction and degenerative changes in the many fine branching canals within a few days, and similar conditions appeared in the periapical tissue soon after. Figure 1 is a photomicrograph of a tooth twelve days after removal of the pulp and infection of the canal with streptococci. It shows one canal in which the tissue is vital and a second canal containing necrotic material. There is a polymorphonu-

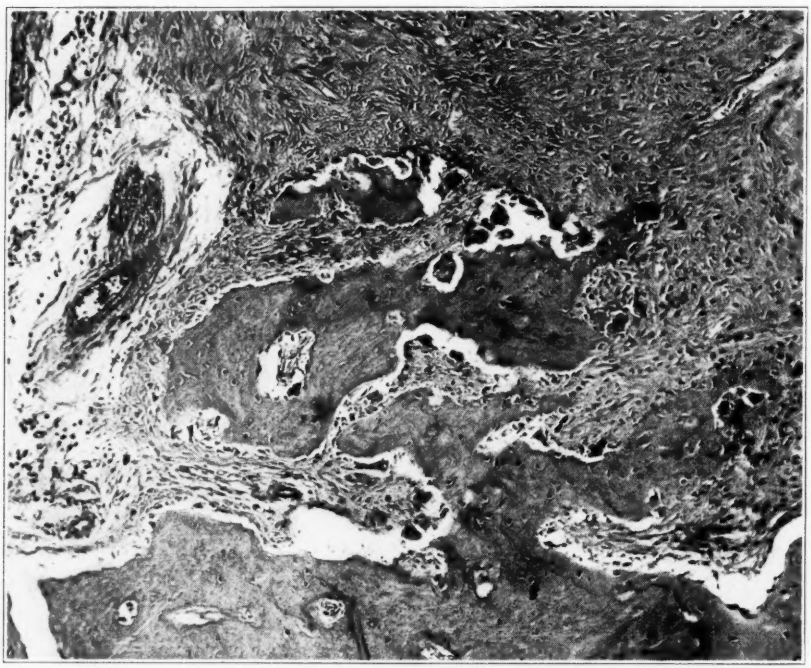

Fig. 4.—Osteoclastic activity in the formation of a dental granuloma.

clear and lymphocytic reaction around the apex. In teeth which were not infected, the tissue within the fine apical canals remained vital for a longer time.

Figure 2 illustrates a sterile pulpless tooth twelve days after pulp removal. The tissues within the more minute

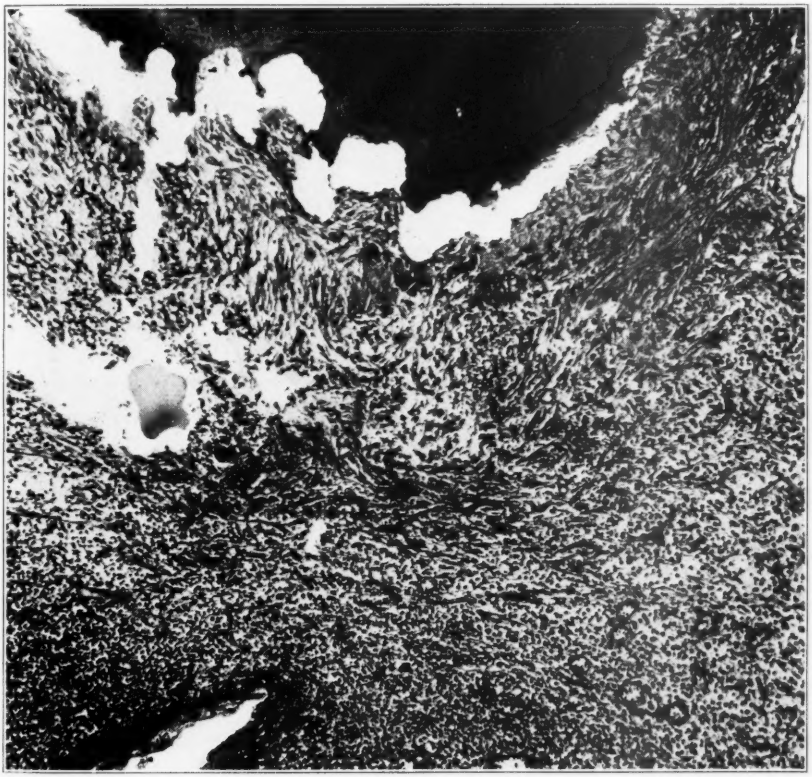

Fig. 5.—Absorption of root five weeks after pulp removal.

branches of the pulp canal are still vital. After a period of quiescence, the periapical tissues of noninfected teeth show an extensive edema involving the regions beyond the apex and an infiltration of a few scattered lymphocytes. Figure 3 is a photomicrograph of a tooth four weeks after sterile pulp removal. The peridental membrane is not detached from the root. This loose periapical structure gradually becomes filled with lymphocytes, plasma cells and connective tissue, which, in some areas, is very dense. Accompanying this condition is a marked osteoclastic activity as illustrated in Figure 4, which shows the rapid absorption of bone and the formation of dense connective tissue adjacent to an area of edema.

Connective tissue and inflammatory

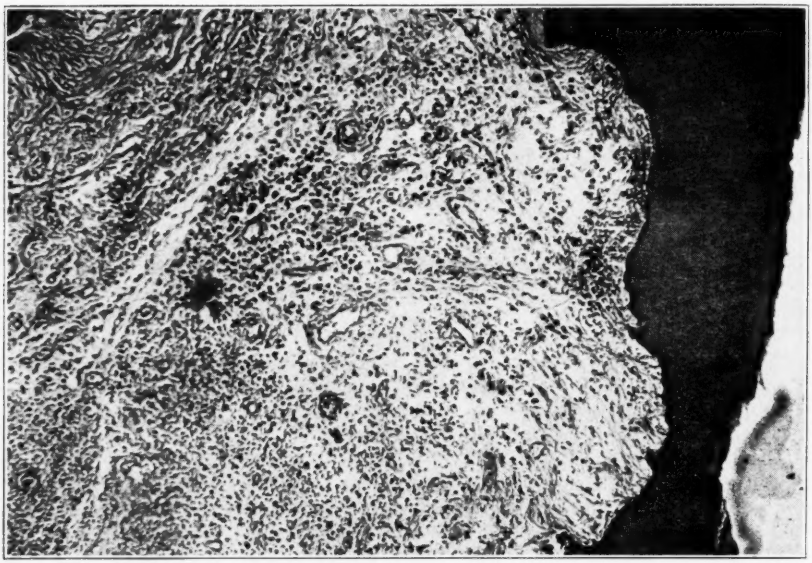

Fig. 6.—Extensive absorption of root in mature granuloma.

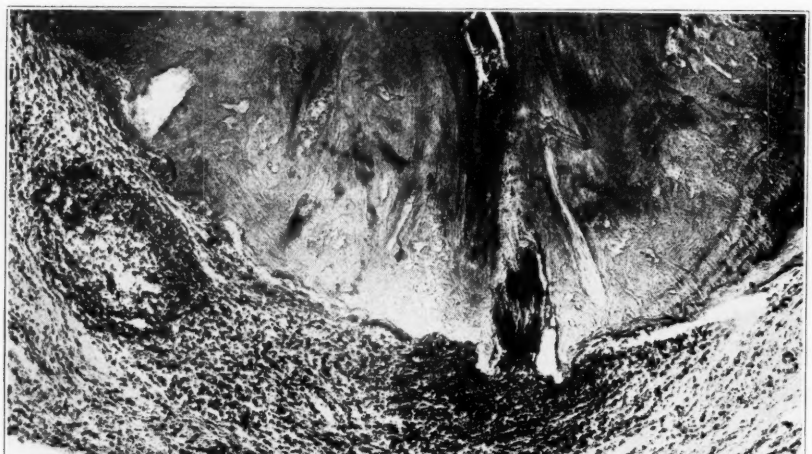

Fig. 7.—Section of tooth four weeks after removal of pulp and infection of canal.

cells gradually fill all edematous areas. Figure 5 is a pulpless tooth five weeks after sterile pulp removal. There is in addition to the inflammatory reaction an absorption of the root surface. This condition is common on the roots of dogs' teeth with granulomas. In advanced, mature granulomas, large areas of the root become absorbed as is shown in Figure 6.

thelial proliferation is common in granuloma of dogs, it does not appear to be constant in granulomas less than 3 months old. Areas of epithelial proliferation are similar in their morphologic aspects to human granulomas. Strands and islands are formed as illustrated in Figure 8. Figure 9 shows a large epithelial island with necrotic center in a granuloma three

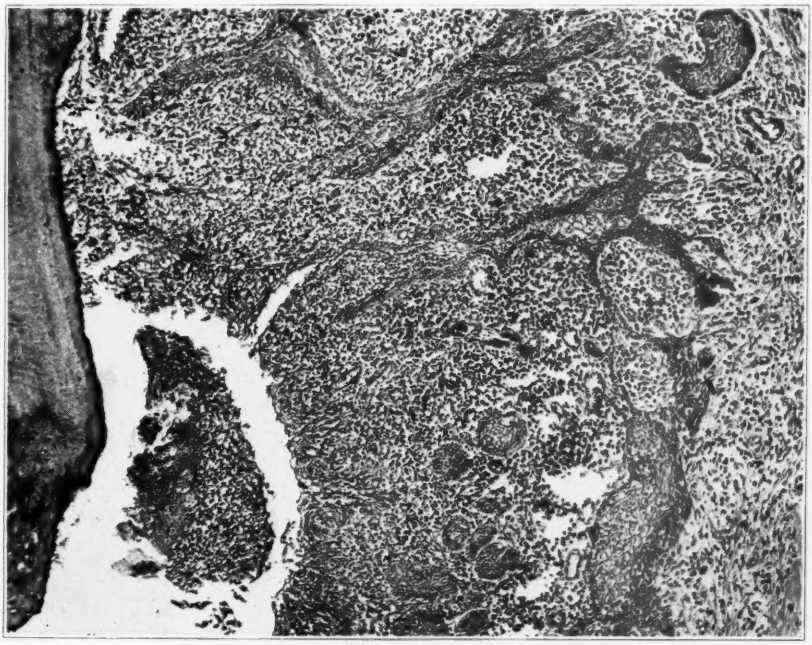

Fig. 8.—Epithelial proliferation in dental granuloma of dog.

Figure 7 illustrates the apex of a pulpless tooth four weeks after removal of the pulp and infection of the canal. This shows inflammatory reaction which consists of polymorphonuclear as well as plasma cell and lymphocytic infiltration.

Epithelial proliferation appears in the formation of granulomas from four to six weeks after pulp removal. While epi-

months after removal of the pulp and infection of the canal.

Bacteria are easily demonstrable in all granulomas after areas of necrosis have appeared. The teeth that were infected with streptococci and allowed to remain for three months all gave positive cultures in dextrose-brain broth, and what appeared to be the same organism used to

inoculate the tooth was recovered, but never in pure culture.

Two incidental observations were made. One granuloma contained cartilage in its outer border, which was the result of connective tissue metaplasia. (Fig. 10.) Absorption of cementum and dentin with rebuilding of new cementum is frequently found on the sides of dogs' teeth, even when these teeth were not under treatment. Figure 11 is a photomicrograph of a tooth adjacent to one under treatment.

Fig. 9.—Formation of cystic area within proliferated epithelium.

SUMMARY

A comparison between the anatomic structure of dogs' teeth and that of human teeth shows a greater branching of pulp canals in the former. Because of this condition and the attending difficulties of complete removal of organic material, the production of dental granulomas may be more readily induced.

In their morphologic and histologic aspects, experimental granulomas in dogs are comparable to human granulomas. Granulomas may be produced on uninfected roots. The type of reaction attending such granulomas suggests that the irritating factor is not caused by infection which has been introduced by way of

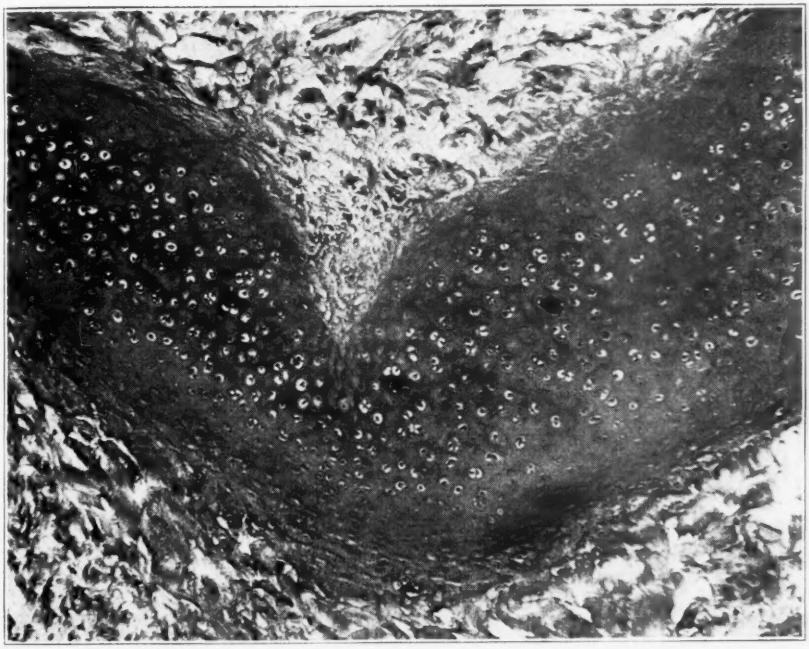

Fig. 10.—Cartilage formation in granuloma.

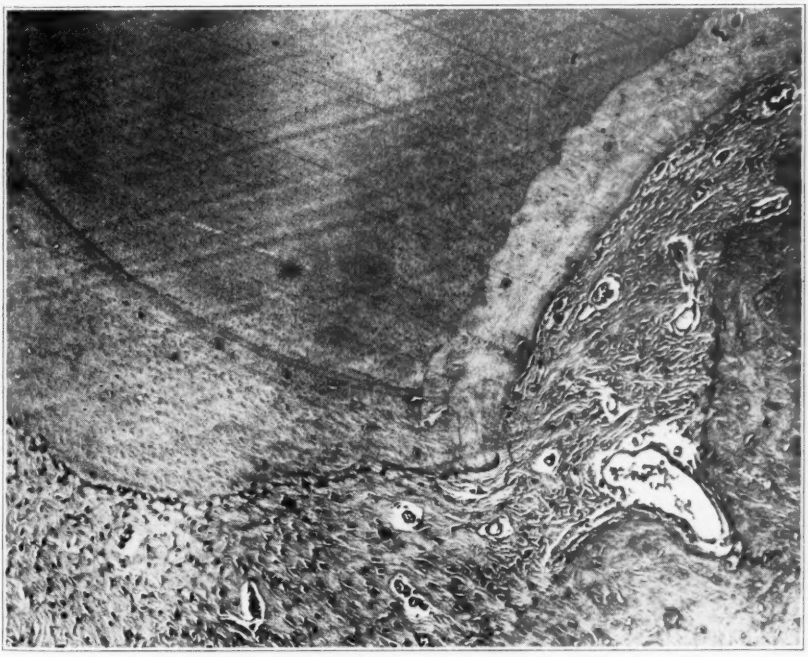

Fig. 11.—Absorption of cementum and dentin and formation of new cementum.

the root canal, but may result from the accumulation of serous exudate in any open root canal. It is possible that the serous exudate within the pulp canal may become altered by its own enzymes or by some other agents which act as an irritant to the periapical tissues. All granulomas produced on both infected and sterile teeth can be demonstrated to contain bacteria after necrosis has occurred. Histologic demonstration of bacteria could not be made in tissue surrounding the roots of uninfected teeth until after the appearance of necrosis. It would appear that, in many instances, the bacteria in dental granulomas are the result of secondary invasion.

CARIES: A RÉSUMÉ OF OUR KNOWLEDGE OF ITS ACTION, TOGETHER WITH SOME OF THE MORE RECENT RESEARCH WORK*

By EDWARD H. HATTON, B.L., M.D., Chicago, Ill.

TO state that recent research work has added nothing of importance to our knowledge of the action of dental caries may be radical. If one studies carefully the investigations and conclusions of Miller, Black and Williams, no other deduction is possible. It is also quite clear that, with perhaps only one exception, the present generation of investigators is either wilfully or innocently ignorant of what seem to be crucial observations of the older school of workers in this field. The latter were not only able to produce typical caries in extracted teeth in the test tube, but were also cognizant of the fact that extracted teeth replaced in the mouth in prosthetic restorations were affected with caries in exactly the same way as teeth with vital pulps and embedded in normal tooth sockets. They knew that caries occurred equally frequently in both vital and pulpless teeth and that the same laws controlled the incidence and distribution of caries in both of these groups of teeth, without any noteworthy difference. They were reasonably familiar with the fact that certain primitive races such as the South Sea Islander, South African and Eskimo were remarkably resistant to dental decay. They and their contemporaries were just as suspicious of the modern diet and made just as radical statements as our contemporaries about the refinement and sophistication of food. "But when to please public taste the manufacturer of superfine flour robs the wheat grain of four-fifths of this phosphate he is destroying the teeth of his customers."[1]

"The introduction of bolts into flouring mills may be regarded as a calamity."[2]

Miller, Black and Williams never wavered from the conviction that caries was caused by the acid produced by bacteria and confined to the tooth surfaces which were affected with caries. The question which they asked then and which they could not answer still defies solution; namely, by what power is

*Read before the Section on Operative Dentistry at the Midwinter Clinic of the Chicago Dental Society, Jan. 20, 1932.

1. Chase, Henry S.: Missouri D. J., 1:115, 1869.
2. Wilson, I. P.: Missouri D. J., 1:233, 1869.

the acid confined to the tooth surface?

How can the foregoing facts be reconciled with the vitalistic, inflammatory theory of dental caries which seems to have the approval and support of such men as Bödecker and Fish? How can they be reconciled with the theories of those who maintain that dental decay is the result of developmental faults and improper calcification of teeth produced by diets deficient in one or more vitamins? There is certainly no circulation in the enamel of a pulpless tooth to inhibit decay, yet pulpless teeth do not decay any more frequently than vital teeth. At least, the discrepancy in frequency is so small as to be of no vital significance. Certainly, defectively formed and poorly calcified teeth seem to be no more susceptible to caries than well formed and adequately mineralized teeth.

Within the last two years, we have been told, "Enamel is a vital tissue." "Caries of enamel begins from within the tooth and not from the outside." "Not only can caries be stopped but the defect can also be remineralized." "Caries can be stopped and prevented by the administration of orange and lemon juice." "Caries is not a bacterial disease but is caused by a deficiency of mineral salts and the mysterious vitamin C." "Caries is caused by a toxic factor or toxamin in cereals such as oatmeal." "It is fundamentally a bone disease and caries and erosion are fundamentally the same thing."

In spite of the fact that investigation of the vitamin is now about 20 years old, the probable composition or identity of only one is known. With this exception, what we know about vitamins has to do with characteristic defects of growth or nutrition which are roughly divided into groups. It has been assumed that a single vitamin deficiency may be and probably is the cause of each group of defects. Although this method of experimentation and reasoning has been surprisingly effective and productive, it has serious faults which can be remedied and corrected only when we know the chemical composition of vitamins and can prepare them by synthetic methods in a pure form. Until then, we are dealing almost wholly with circumstantial evidence, which we know is in other fields often highly unreliable.

However this may be, we are entirely justified in believing that vitamins have much to do with the growth and development of teeth, as well as with maintaining them in a healthy condition. The vitamins concerned, in the opinion of present-day investigators, are vitamins A, C and D. Deficient A diets not only interfere with growth and development of teeth, but also cause profound effects on epithelium, including that of the lachrymal and salivary glands. Diets deficient in C not only cause scurvy but also cause extensive changes in the pulp. Indeed, the dental pulp seems to be more sensitive to variation in vitamin C content of the food than any other part of the body. Incomplete calcification of the dentin and amorphous calcification of the pulp are very marked and in a specific manner. Food deficient in vitamin D, besides interfering with bone formation and causing rickets, damages growing teeth. From these facts, it has been assumed that such deficient diets may be a factor or the most important factor in the causation of dental caries. It seems to be the opinion of this group of present-day investigators that teeth which are poorly formed and defectively calcified are more susceptible to caries than those that are well formed and fully calcified. Mrs. Mellanby has the notion that vitamin D is the important factor in the prevention of caries. Hanke

jumped to the conclusion that the cause of caries is to be found in a C deficiency, presumably because of the pulp and dentin changes that accompany scurvy. Both he and Mrs. Mellanby have become confirmed in their beliefs by the successes that they have noted in the use of orange juice and cod liver oil, respectively, in the clinical management of groups of children. Howe has wavered somewhat in his choice of vitamins, but his last statement already quoted fixes his choice on "a deficiency of mineral salts and the mysterious vitamin C."

I am aware of the highly controversial character of the vitamin relationship to dental disease. At the present time, to paraphrase a statement once used in another connection, it is still a fertile field for exploitation by the biologic romancer and the charlatan. One cannot escape believing that although vitamins have much to do with the preservation of the health of the dental structures, we are still grossly ignorant as to their specific relationship to caries. The conclusion that poorly calcified and defectively formed teeth are more suspectible to caries is especially weak. It does not harmonize with many well known clinical facts. In tooth resorption, it is a fact that densely calcified teeth are more readily resorbed than those that are poorly calcified; and mottled enamel is more resistant to decay than normal enamel. Diets rich in vitamins are, as a rule, those that have high mineral content and that tend to build up the alkali reserve; all of which have been said to be important in the prevention of decay.

Eddy,[3] in discussing this question, made the following statement:

> Empirically I think Hanke is justified in trying out his pint of orange juice treatment, and urging others to try it, provided it is understood that such treatment may be expected to yield both success and failure, and that the failures should be even more carefully noted and studied than the successes. This nutritional attack on caries is not going to glorify any single factor, and we must not let our enthusiasm cloud our logic or induce neglect of the study of contributory measures. . . . Davis' enthusiasm over his alfalfa-copper-iron treatment for anemia, and his balanced calcium-phosphorus pills to restore dentin to normalcy, would register more strongly with me if his advocacy led him to the publication of more experimental data and less manipulation of observations made in quite other types of studies to justify his procedures.

In other words, although Hanke states that he has produced a 48 per cent reduction in the incidence of dental caries in his experimental group of children through the administration of orange and lemon juice, we should not emphasize this improvement, but critical consideration should be given to those cases in which improvement did not take place. Not that any method which will consistently reduce the incidence of caries should be dismissed as unimportant, but that, from the standpoint of advancing knowledge, it is the failures rather than the successes that are important. At the present moment, Hanke is not willing to state that administration of vitamin C prevents caries—merely that his dietary program has reduced the incidence of caries. We may infer that it may be something other than vitamin C. Until we know what it is, we must insist that the 52 per cent failure to attain perfection is more important than the 48 per cent improvement.

Clinical experimentation has two contrasting properties: it is exceedingly difficult to manage, but, when well managed and critically interpreted, the results are final.

Howe is quite definite in his last statement as quoted, but it is not all clear just

3. Eddy, W. H.: J. D. Res., 11:353 (June) 1931.

what the clinical or experimental foundation for that opinion is, although we know that there is a substantial foundation of both laboratory and clinical experimentation of a certain kind, which I believe deserves the criticism that was recently made on certain phases of it.

Of the work referred to in the second quotation from Eddy, one may say that it represents a third type of so-called investigation in this field entirely without redeeming features.

One is driven to the conclusion that the vitamin C deficiency theory for the etiology of dental caries is entirely unproven.

There is no outstanding reason for a lengthy discussion of Mrs. Mellanby's work. She is the most vigorous exponent of the vitamin D deficiency hypothesis regarding tooth decay, although she assumes that one other factor is of material importance. She insists that cereals contain a toxic material that increases the susceptibility to decay and that this material is found in the greatest concentration in oatmeal and white flour. She believes that she has experimental and clinical evidence to warrant and justify her theories. Her explanation is composed of a restatement of the old notion that cereals and particularly flour that have been overrefined are harmful and the belief that poorly calcified teeth are likely to decay. Hess[4] states: "It was found that children who had been protected from rickets had developed less caries than those who had not been protected. Nevertheless, numerous instances of dental caries were found in the non-rachitic group."

The situation with vitamin D, then, is practically parallel with that with respect to vitamin C. Hess advances the opinion, in the same article, that a lack of the antirachitic factor leads to dental caries, but also that it is not the dominant factor. May we not say, as was said for orange juice, that the antirachitic diet contains something not vitamin D that favorably influences caries?

A small group of investigators have suggested the theory that the cause for decay is to be found in derangements of metabolism that have to do with the maintenance of the acid-base balance and is associated with a depletion of the alkali reserve. Such a concept is not far removed from that theory which assumes that caries is due fundamentally to a lack of minerals, particularly calcium and phosphorus, in foods. The two conditions are roughly parallel. This idea has, it seems, been advanced by McCollum and his group. In a recent number of the *Science News Letter,* a summary of a paper to be published at an early date is given. According to these authors, caries is due to failure of the buffering action of the saliva. They believe that there are buffering substances in healthy saliva that prevent or inhibit caries by neutralizing acids. These buffering substances are dependent on the secretion of calcium and phosphorus into the saliva. This predicates not only the ingestion of ample amounts of these minerals with foods but also the regulation of mineral metabolism so as to promote absorption of them into the body and regulation of their passage through the tissues and fluids. This, the authors assume, is brought about by vitamin D.

The last phase of modern research into caries that I mean to discuss has to do with investigations that are essentially bacteriologic. These investigators have been chiefly concerned with the organisms involved and stimulated by the possibility that caries may be caused by a specific germ and that if this is so, the

4. Hess, A. F., and Abramson, Harold: D. Cosmos, 73:849 (Sept.) 1931.

problem of caries management may be reduced to rather simple terms, both as to early diagnosis and as to immunization. To me, this is the significance of what Lazarus-Barlow, Bunting, Rodriguez, Jay and others have been doing. Is the acid produced by only one type of germ or a number of different organisms? If it is a single germ disease, or a specific germ disease, is the active agent *Bacillus acidophilus,* or, as some call it, *Lactobacillus acidophilus-odontolyticus*? Even granting that it is, although one cannot assert that their proof satisfies all of Koch's laws, they are still confronted by that old question: How are the bacterial colonies and the associated acid confined to the surface of the teeth?

Can the environment of the mouth be made sufficiently unfavorable for this organism by drugs or chemicals or mouth washes or by oral hygiene? They have experimented along these lines and, according to our latest information, the results are unsatisfactory. Does the saliva of those who are immune to caries contain antibodies to this organism that assure freedom from caries? As yet, they do not know, and this is a hard experimental problem to solve. Is the environment made favorable for these organisms by the character of the diet or by some peculiarity of the metabolism due to the influence of vitamins, internal secretions or alkali reserve?

The last question has been partly answered because both their laboratory and their clinical investigations have given them some reason to believe that there is some such influence. At least, the only noteworthy success that they have reported in the control of both *B. acidophilus* and caries is chiefly concerned with the management of the diet.

All of the successful diets, including the one just referred to, do not, it seems to me, differ in any noteworthy respect. Such successful diets provide rather liberally for the mineral needs of the body. They contain vitamins in abundance. Carbohydrates are restricted to the essential energy needs of the body, and the ash balance is distinctly alkaline. Of course, it is true that they differ in minor details, especially as to the vitamin content, but, in general, it may be said that all contain adequate amounts of all of the vitamins.

Of this last group of investigators, I think it may be said without danger of contradiction that not only have they begun at the point where the older investigators stopped, but they are also cognizant, in every essential detail, of what has been done in the past.

If there is any exception to the first statement made in this paper, it must be found in the investigations that have something to offer in answer to that question: How are the acid and the bacteria confined to the regions that decay? That is still the important question. No clue to the answer can be found in theories that are based on a belief in enamel vitality, or in the circulation of lymph in the enamel, or in the origin of decay from within the tooth. Nor is the vitamin hypothesis in itself suggestive of a solution. It is not at all true that defectively formed and defectively calcified teeth are strikingly more susceptible to caries.

I may be wrong but I firmly believe that it is in the environment of the tooth that the answer is to be found. I cannot accept Howe's pronouncement that "caries is not a bacterial disease," but that it is "due to a lack of the mineral salts and the mysterious vitamin C," without many reservations. I am still convinced that bacteria and acid play the major rôle. I believe we are still justified in trying to determine what bacteria do and

how they are influenced in their behavior. It is perhaps too early to comment on the theory of the buffering action of the saliva proposed by McCollum, but we must welcome such a change in the nutrition approach to the causation of caries.

May it be said that the control of caries has passed out of the hands of the operative dentist? I think not. Early recognition and prompt treatment by filling the cavity and the adjacent susceptible area have done more to limit the action of caries than the attempted application of the latest discoveries in the field of nutrition. Both success and failure have been recorded in the attempts to modify the action of caries by variations in diet. We are prone at the present time to stress the successes and give little thought to the failures. Both should be recognized, to the end that no method that gives some promise of restraining the action of caries should be ignored in its entirety and that, further, no method should receive more emphasis than it actually deserves.

REPORT OF A CASE

By NORMAN L. HILLYER, D.D.S., Brooklyn, N. Y.

History.—E. R., a girl, aged 8 years and 3 months, came in for treatment, Jan. 2, 1929. Her vision, hearing and mental development were good; weight, 58 pounds; height, 4 feet 3 inches; oral health, excellent, with small occlusal pit fillings in both upper first permanent molars, but no other fillings or caries. The birth had been normal, the weight at that time being 6¾ pounds. The patient was

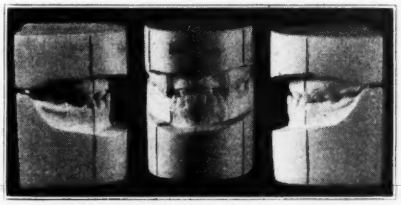

Fig. 1.—Models of case at beginning of treatment.

breast fed until the age of 11 months, then weaned and placed directly on a solid diet. She was never bottle fed. The father and mother, both of Irish descent, had good arch form. The patient had her adenoids and tonsils removed at 5 years of age, and had an appendectomy at 10½. She had had measles at 10 and mumps at 11 years. Her only brother, aged 4 years and 2 months, had good arch form, and at the time of treatment of his sister had normal spacing between the upper and lower anterior deciduous teeth. (There were no sisters.) The upper deciduous anterior teeth were firmly in place

Fig. 2.—Occlusal view of models.

until about 7 years. On their loss, the upper permanent anterior teeth were immediately erupted lingually from the positions occupied by the corresponding deciduous teeth.

Etiology.—No systemic cause for this abnormality was discoverable in the heredity

of the patient as reported by the mother. The anterior deciduous teeth of the upper arch seem to have been retained overlong and no usual spacing seems to have occurred before the eruption of the upper permanent anterior teeth.

Diagnosis.—The case was placed in Class 1 (Angle), a neutroclusion with a lingual position of the upper permanent central and lateral teeth (Lischer); and Simon's classification, as follows, was taken into consideration: bimaxillary, alveolar, anterior contraction, mild and symmetrical; maxillary, alveolar, anterior retraction, severe and symmetrical; maxillary, alveolar, anterior attraction, mild.

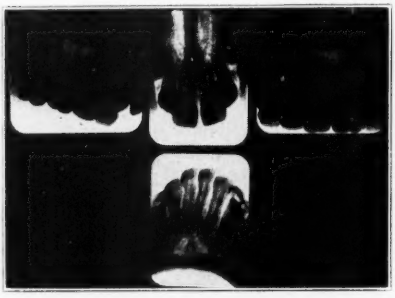

Fig. 3.—Anterior teeth.

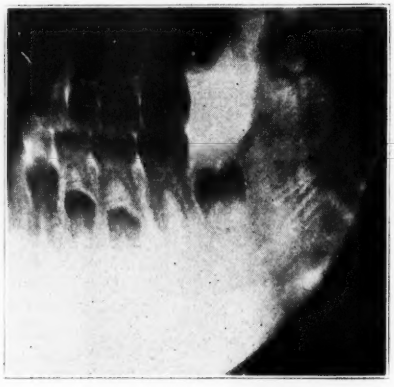

Fig. 4.—Right posterior teeth.

(It is well known that the terms of the last system of classification are being severely criticized, and, it seems, rightly so, by Dr. Dewey and by others, but until better ones are found, I am contenting myself with the terms mentioned and hope that one of the classifications given will be adequate for this case.)

Treatment.—The case having been diagnosed as indicated, it was decided that an upper lingual arch with bands on the upper first permanent molars would, with properly chosen and properly placed springs, carry the upper anterior teeth into position with the least interference with function and appearance and with the most efficiency. Therefore, January 16, an upper lingual arch of 0.038 gage wire was placed and fixed by

Fig. 5.—Left posterior teeth.

Fig. 6.—Profile roentgenogram, illustrating lack of development in upper anterior region and lack of excess development in mandible.

half round vertical tubes and locks to the first molar bands, which were cemented on these teeth.

Figure 1 shows the models of the case at the beginning of treatment; Figure 2, the occlusal view of these models; Figure 3, the anterior teeth, and Figure 4, the right posterior teeth as shown in the roentgenogram.

Fig. 7.—Profile photograph at commencement of treatment.

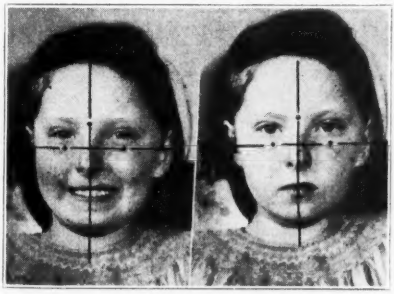

Fig. 8.—Front view taken at commencement of treatment.

Figure 5 shows the left posterior teeth, and Figure 6, a profile roentgenogram, which is interesting in that it illustrates the lack of development in the upper anterior region and no excess development of the mandible. Figure 7 is a profile photograph taken at the commencement of treatment, and Figure 8, a front view taken at the same time.

February 23, a recurrent auxiliary spring of 0.020 gage was soldered to the arch to induce labial movement of the upper central incisor teeth. This spring was adjusted only twice (March 27 and June 19), until these teeth were in fairly good position and were labially from the lower incisor teeth in occlusion; i.e., September 25, when I saw the patient on her return from a three months' vacation.

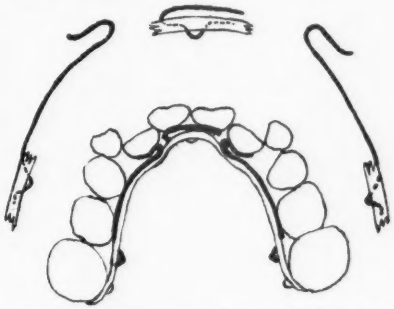

Fig. 9.—Appliances and method of attachment and adaptation of springs.

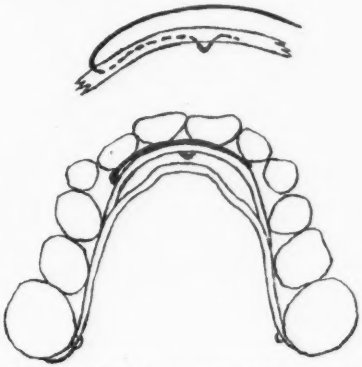

Fig. 10.—Method of reshaping the main arch and spring finally used.

It must be stressed here, and perhaps many times, that the spring was adjusted only at infrequent intervals, because I have repeatedly found that, in my hands, treatment progresses faster and more physiologically with the minimum amount of pressure and that applied only as often as is necessary to get the maximum result. The

patient was seen at least once every three weeks, except during the summer vacation.

September 25, two simple auxiliary springs were soldered in the second deciduous molar regions and adapted to the upper lateral incisor teeth. At this stage, I experimented a little to see which gage wire, under like pressure, would have a better effect, 0.020 or 0.022. The left lateral spring was made of 0.022 wire, while the right was of 0.020. The same adjustment was given each and

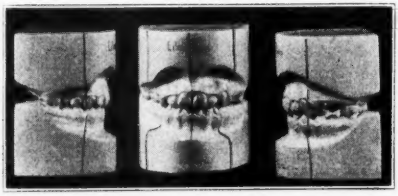

Fig. 11.—Final models (Dec. 23, 1931).

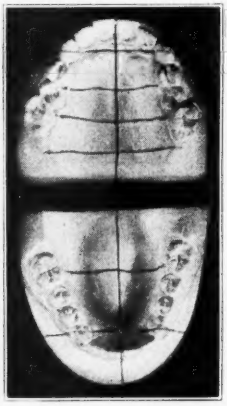

Fig. 12.—Occlusal views of final models.

the two teeth to be moved were in very nearly identical malocclusion. It was found two months later, November 15, that the right lateral incisor with its 0.020 spring had made the greater progress, and therefore the left, 0.022, spring was replaced by a similar spring of 0.020 wire, and both right and left springs were adjusted.

No further adjustments were made until January 6, 1930, when both springs were removed. It was then apparent that the anterior teeth were too far away from the main arch wire and the arch must either be remade or readapted to the new dental arch form. I have found an easy and efficient means of reshaping the same arch wire to the new arch form, a little different from that shown by Dr. Porter.

Figure 9 shows the schematic drawing of the appliances and the method of attachment and adaptation of the springs. Figure 10 shows the method of reshaping the main arch and the final spring used.

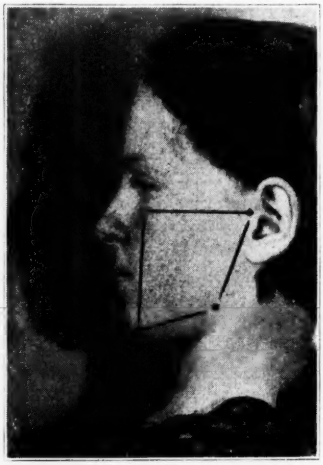

Fig. 13.—Profile photograph.

Fig. 14.—Front views.

In this case, a piece of 0.038 wire was beveled to give a good joint at the right cuspid area and soldered. The new piece was adapted to the new dental arch and cut to size and soldered where it again

joined the old arch at the left cuspid area. The old anterior section was now cut from the new arch and the soldered joints filed and polished. We now had a new arch to fit the new dental arch accurately without an impression or model or without disturbing the relationship of the half-round first permanent molar posts.

To this newly formed arch, an 0.020 recurrent auxiliary spring was soldered the same day (January 6), to carry the four upper incisor teeth to better position. This spring was adjusted once, March 21. The accompanying table gives the dates that the

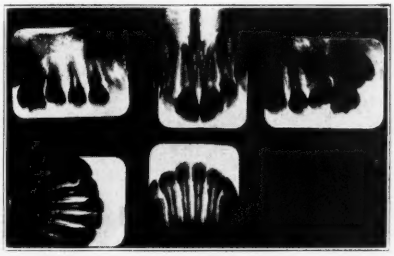

Fig. 15.—Anterior roentgenograms.

Fig. 16.—Left posterior roentgenograms.

appliances were placed, adjusted and removed.

The entire appliance was removed, May 26, and the case observed at four-month intervals until the final models were taken, Dec. 23, 1931. Figure 11 shows the models on that date; Figure 12, the occlusal views; Figure 13, the profile photograph, and Figure 14, the front views.

Figure 15 shows the anterior roentgenograms; Figure 16, the left posterior roentgenograms; Figure 17, the right posterior roentgenograms, and Figure 18, the profile roentgenogram.

The anterior alveolar region of the upper arch shows development.

Comment.—Had it not been necessary to take these final records for this report, I should have extended the period of observation longer to be sure that the erupting bicuspids came into proper occlusion. It seems probable that they will do so.

Fig. 17.—Right posterior roentgenograms.

Fig. 18.—Profile roentgenogram.

It should be noted that no "retainer," either fixed or removable, was used to hold the teeth in their corrected positions. I relied, as I almost always do, on the forces of occlusion and on the slow, gentle and constant method of treatment to insure a lasting result.

Dr. Mershon gave some of us a course in his theories and practices with the lingual arch in New York some years ago and, regarding retention, gave us an axiom which has far-reaching implications and which is very true regarding any method of treatment: "You can push teeth to where you think they belong; Nature will move them to where they will best adapt themselves to the rest of the organism."

Prognosis: It seems that the prognosis is favorable and that the lingual position of the erupting upper second bicuspids will correct itself when full occlusion is attained by growth. No relapse has been noted except very slight irregularities in the anterior teeth which, to my mind, need no further correction.

Results and Conclusions.—I feel that this case has demonstrated the advisability of using gentle, constant, infrequently applied pressure, derived from light gage springs on a lingual removable arch wherever conditions permit. The case reported is such a one, and the lingual arch, while certainly not a "universal appliance," as used is the most efficient mechanical appliance that we can employ in attaining the greatest physiologic tooth movement and in the easiest manner both for the patient and the operator, in the shortest space of time.

APPLIANCES

	Upper Lingual Arch	1|1 Spring	2|2 Springs	21|12 Spring
Placed	1/16/29	2/23/29	9/25/29	1/ 6/30
Adjusted	1/ 6/30	3/27/29	11/15/29	3/21/30
	Reshaped to new position of upper anterior teeth	6/19/29	Changed 0.022 to 0.020	
Removed	5/26/30	9/25/29	1/ 6/30	5/26/30

JOHN HARRIS: A CONSERVATIVE VIEW OF HIS PLACE IN DENTAL HISTORY

By LAWRENCE PARMLY BROWN, D.D.S., Peekskill, N. Y.

THE building of a sound biographic foundation for a definitive history of dentistry seems to require conservative appraisal of John Harris, for there is convincing evidence that he has been much overrated by Edward C. Mills and also by Bernard W. Weinberger.[1]

I have an extensive genealogic record of the American branches of the Harris family to which John the dentist belongs. He was the compiler of the earlier part of this record, according to one of his surviving descendants, from whom it was obtained. It begins with James Harris, who came from England before the Revolutionary War. One of his sons was John (1773-1791), who married during his residence in Salisbury, Conn., and had three daughters and three sons, the latter being the dentists James Harvey (1795-1836), John (1798-1849) and Chapin Aaron (1806-1860). John Harris the dentist married a widow, Mrs. Martha (Edmiston) Wampler, in 1827, while a resident of Bainbridge, Ohio, and by her had three daughters and four sons, including Silas Canon, the youngest, who became a newspaper publisher and editor in the Middle West. He is the only child of John the dentist who had issue: two children who died in infancy, by his first wife, and four sons, by his second wife, three of whom are still living, with five children in all. The only descendant of John the dentist known to Mills and Weinberger is a daughter, the first-born (1828-1833), whose tombstone was discovered by Mills at Chillicothe, Ohio.[2] The six other children of John the dentist were minors when their father died (1849), and their guardian was Chapin A. Harris, whose surviving daughter, in a letter to me, says: "The sons, when they came under my father's guardianship, were half grown, at least [the youngest was in his seventh year], and gave him a great deal of trouble. His brother [John] left some property, I know; but I understand that my father had to spend a great deal on them [the children]."

The principal records relating to the character and activities of John Harris the dentist are his obituary, with James Taylor's preface,[3] and some statements by Taylor in his "Life and Character of Chapin A. Harris,"[4] but these must be considered with caution, as obituaries are often too laudatory, while Taylor as a friend and former student of John Har-

1. Mills, E. C.: John Harris, M.D., D.D.S., Bull. Ohio D. Soc., 1:106-111, 1927; Tr. A. D. A., 1930, pp. 201-207. Weinberger, B. W.: Educational Evolution of Dental Surgeon, D. Cosmos, 71:516-526 (April), 565-575 (May) 1929; John Harris, Father of American Dental Education: His True Place in American Dentistry, ibid., 71:1074-1081 (Nov.) 1929. Mills, E. C.: Bainbridge, Ross County, Ohio, Cradle of Dental Education, J. A. D. A., 19:361-389 (March) 1932.

2. Footnote 1, first reference, p. 110; third reference, p. 381 (compare fourth reference, p. 381).

3. D. Reg. West, 3:49-51, 1849.

4. Taylor, James: D. Reg. West, 15:79-80, 1861.

ris may reasonably be suspected of some overstatement. In his preface to the obituary, Taylor implies that he was not its author; but even if he had a hand in its compilation, there can be little doubt that some of its statements were derived from family information, which is often supplied from memory, and therefore seldom can be accepted without verification, especially in the matter of dates.

Taylor says in his preface:

> In giving place to the following obituary notice of Dr. J. Harris, we feel compelled . . . to add a few remarks.
>
> We first knew Dr. Harris in 1825, shortly after his location in Bainbridge, Ross County, Ohio, at which time we entered his office as a student of medicine . . . we must say that we know of none better calculated to advance a student in his studies. It appeared to be with him not only a duty, but a pleasure, at the close of every day, to review the studies thereof, to explain and enforce each lesson. . . . The success of his practice of medicine was the result of his thorough knowledge of his profession, and we have always thought, had he devoted himself exclusively to the practice of Medicine and general Surgery, that he would soon have enjoyed an enviable reputation. His attention, however, was turned more especially to the specialty of Dentistry.

In the obituary of John Harris, we find:

> He was educated for the medical profession, and commenced practice in Ohio about 1819, but in 1820 or 1821, removed to Mississippi. . . . About the year 1821 his attention first began to be directed to dental surgery; but he did not wholly relinquish the practice of general surgery till about the year 1827 [probably a typographical error for 1829, as we shall see]. He had, however, by this time, acquired considerable skill as a practitioner of dentistry, and had made himself acquainted with the writings of the best authors upon the subject. As a physician and surgeon he enjoyed a high character.
>
> In dental surgery, Dr. Harris was principally his own instructor, and although he had read the best works extant upon the subject, and obtained from an itinerating dentist some knowledge of the constructive branches of the profession, he, nevertheless, was compelled almost entirely to rely on deductions drawn from medical and surgical facts, and his own observations, for theory to guide his practice of [dentistry].
>
> He practiced in almost every principal town in the west and southwest. . . .
>
> Few have ever commenced the practice of dental surgery with so high a reputation for skill as a physician and surgeon. . . . In the year 1835-'36, he prepared a series of articles, which were published in the "Kentucky Commonwealth," printed at Frankfort, explanatory of the dentist's profession. . . .
>
> Soon after Dr. Harris devoted his undivided attention to dental practice, he pointed out to members of the profession the importance of a systematic course of [dental] instruction, with an especial application of medical and surgical teaching to the wants of the dental surgeon. Agreeable with these views, he made an effort, in 1836, to obtain a charter for a dental college in Kentucky, with means for teaching and powers for graduating for practice the dental student, and although this effort to secure legislative privileges for educating the dentist was unsuccessful, still it is worthy of remembrance, as being the first effort in this country to establish an institution of the kind.
>
> During the winter of 1835-'36, in compliance with the request of the Faculty and Students of the Medical Department of the Transylvania University at Lexington, Kentucky, Dr. Harris delivered a course of dental lectures before the medical class of that institution. These lectures, probably are marked as the first successful effort at a systematic course of teaching dental surgery in the west, if not in the United States.

Taylor's "Life and Character of Chapin A. Harris" includes the following statements:

> Dr. John Harris must have located in Bainbridge in 1826 [or 1825, as above], and Dr. C. A. Harris, in Greenfield, in 1827. In the latter year, the former turned his attention to the practice of Dental Surgery. He had acquired considerable reputation as a general surgeon, and was a skillful and ready operator. He was much devoted to the study of anatomy and chemistry, fond of experimenting [probably in chemistry], had a quick and active mind, was polished in his manners, delighted in imparting instruction to his

pupils, devoted much time to their interests, and prided himself much in their advancement in medical knowledge. At that time (probably 1825-1827) he had three or four students, two of whom followed his example in the pursuit of dental knowledge, myself being one of them. Being among my relatives and friends, and acquainted in all the surrounding towns, I had fine opportunities for putting into practice the little knowledge acquired.

The insertion of artificial teeth being then something of a novelty, Dr. John Harris and myself extended our practice to some of the adjacent towns, and while thus engaged, visited Greenfield in 1828. Dr. C. A. Harris being there at the time [practicing medicine], we operated, to some extent, in his office, and among his patrons and friends; and here began, on his part, that career of dental study, which expanded and strengthened, till it culminated in a rich stock of dental knowledge. . . .

Dr. John Harris and myself had many protracted discussions on the importance of a thorough medico-dental education, and the best method of securing it; and in these we were joined by Dr. C. A. Harris, on one or two occasions, or perhaps oftener. The leading ideal, for several years, was to have a department of dental surgery attached to medical colleges. . . . Prof. C. A. Harris certainly is entitled to the credit of making the first movement in the right direction, and of establishing that system of instruction which alone can give character and stability to our profession. [Referring to the Baltimore College of Dental Surgery, conceived in 1839, chartered and opened in 1840.]

Viewing the foregoing evidence as a whole, and allowing for probable exaggerations, it seems safe to conclude that in the earlier part of his career, John Harris was a reputable physician and surgeon, but was not especially successful and therefore supplemented his practice of medicine with some dentistry, leaving Bainbridge and devoting himself exclusively to the latter profession about 1829. There is no evidence that he was active in any medical society or that he contributed anything to the literature of medicine. Like many others, he gave instruction to some medical students in preparation for the regular college course, and doubtless was a conscientious preceptor. Two of his medical students became interested in dentistry while in his office, and afterward practiced it (according to Taylor); but his knowledge of this profession appears to have been rather meager during his Bainbridge period. According to his obituary, he had learned something of "the constructive [mechanical] branches" from an itinerant dentist, but "was principally his own instructor"; the further statements to the effect that he had read the best extant works on dental subjects doubtless being an exaggeration, as such books were scarce in America when he was at Bainbridge, and the best of them were in French, which language he probably did not read. Moreover, Taylor speaks of "the little knowledge" of dentistry acquired by himself during his studentship with John Harris.

That John Harris advocated some sort of medicodental education around 1828 is stated both in the obituary and by Taylor; the "leading ideal," according to Taylor, being "a department of dental surgery in medical colleges," which doubtless had been suggested previously by others. The obituary also states that John Harris made an unsuccessful effort to obtain a charter for a dental college in Kentucky in 1836, seemingly for an independent institution (Weinberger's statement to the effect that it was to have been a department of the Transylvania University being a mere assumption.[5] As an application for such a charter of incorporation requires a number of signatures, the writer of the obituary may mean that John Harris was the originator and chief promoter of the Kentucky project; but the 1836 of the obituary appears to be three years earlier than the

5. Footnote 1, third reference, p. 1075.

correct date. I have had a search made at Frankfort, the capital of Kentucky, the only result being the discovery of four official records of "A Bill to incorporate the College of Dental Surgeons of Kentucky," without mention of the applicants for the charter (in the *Journal of the Senate* for the session of the Legislature of 1838-1839). This bill was introduced, Jan. 17, 1839; reported, January 25; ordered engrossed, January 31, and, with others, had a third reading, February 1, when it was "Resolved that the said bills do pass, and that the titles thereof be as aforesaid" (pp. 149, 191, 217, 232). As there is no further record relating to the bill for the dental college, the obituary appears to be correct in stating that the effort to obtain the charter was unsuccessful. The application for this charter seems to have been made early in January, 1839, about a year earlier than the successful effort in the case of the Baltimore College (chartered Feb. 1, 1840). There can be no reasonable doubt that John Harris was one of the applicants for the Kentucky charter, which seems to give him his chief claim to a place in the history of dentistry; but there is no proof that he was the originator of the Kentucky project, or its leading spirit, and even if he were, it is possible that he received the suggestion for it from his brother, Chapin A. Harris, for Taylor says that the latter "certainly is entitled to the credit of making the first movement in the right direction."

There can be little or no doubt that an independent dental college was projected as early as 1834 or 1835 by the Society of Surgeon Dentists of the City and State of New York, the world's first dental association. At its first meeting, it decided by formal resolution to apply for a charter from the State of New York conferring the privileges "of instituting a dental library and lyceum in the City of New York, and of granting diplomas,"[6] and Shearjashub Spooner states in 1836: "It is also the intention of the Society to petition the State Legislature . . . for a charter to found an institution for qualifying students to practice dentistry."[7] John B. Rich probably refers to this project when he says: "The reason the college could not be established in New York was that the men whom we appointed as professors would not serve because there was no money in it and they could not spare the time."[8]

Levi S. Parmly,[9] says: "A great improvement of the department of surgery, will depend on pointing out to society the importance of preventing diseases of the teeth. . . . Nothing can tend so much to accomplish this object, as an institution for the exclusive promotion of dentalogical science . . . and such, we flatter ourselves, we are authorized shortly to anticipate." This statement seems not to refer to a college for dental students, but to "an institution" for instructing the public in dental matters by means of lectures such as were delivered by Levi S. Parmly to the public in London, 1819, and in New York, 1820.[10]

The statement in the obituary that John Harris delivered a course of dental lectures before the medical class of the Transylvania University in 1835-1836 cannot be confirmed (Weinberger),[11] but there is no reason to doubt it. In all probability, this course included only den-

6. Brown, L. P.: New Light on Dental History, D. Cosmos, 62:939 (Aug.) 1920.

7. Spooner, S.: Guide to Sound Teeth, 1836, p. 112.

8. Footnote 6, pp. 948, 957.

9. Parmly, L. S.: Practical Guide to Management of Teeth, 1819, p. iv.

10. Parmly, L. S.: Lectures on Natural History of Teeth, Ed. 2, 1819; Ed. 3, 1820.

11. Footnote 1, second reference, p. 573.

tal anatomy, physiology and pathology (for mechanical dentistry and operations on the teeth have no interest for medical students); and such lectures had been delivered in London as early as the close of the eighteenth century, by Hunter, Rae, Fox, Moore, Fuller and Blake.[12] Chapin A. Harris, in the first edition of his "Dictionary of Dental Science" (1849),[13] gives us a biographic sketch of Horace H. Hayden, in the course of which we find: "In such high estimation was he held, that he was invited about the year 1825, to read a course of lectures, on dentistry, before the medical class of the Maryland University." In 1851, the same authority stated: "About 35 years ago the late Dr. Hayden of Baltimore delivered a course of lectures on dental Surgery in the University of Maryland—the experiment, however, was unsuccessful."[14] This statement points back to 1816; but the 35 may be a typographical error for 25, the original reference having been to 1826 or 1825. Simon in his "History of the Baltimore College of Dental Surgery" (reprint 1904, p. 7) says of Hayden: "Almost from the time when he began the practice of his profession in Baltimore [about 1801], he was accustomed to hold classes in dentistry in his office at night"; adding that he gave a course of dental lectures before the medical class of the University of Maryland in the session of 1837-1838. The statement of Chapin A. Harris regarding Hayden's dental lectures of about 1825 is followed with variations by Thorpe in his biography of Hayden, where the year appears definitely as 1825. Thorpe gives no reference to the source of his statement, and as this source is unknown to Weinberger, the latter questions the truth of Thorpe's statement, and accepts that of Simon referring to 1837-1838[15]; but we now have evidence that Hayden's first period of dental lectures extended from about 1821 to about 1825, as set forth in the following extracts from an article by J. Ben Robinson entitled "Dr. Horace H. Hayden and His Influence on Dental Education," in the 1932 *Mirror,* the student annual of the Baltimore College (p.18):

> The Catalogue of the Dental Department, University of Maryland, had from its beginning in 1882 given the date of the first dental lectures as "1837," but in 1904 and for the years following, the Catalogue carried the following information: "In 1821-22 the first dental lectures in America were delivered in the University of Maryland." This was written by Dean Gorgas, and because of its abrupt appearance indicates some new and convincing evidence which he had discovered. . . . Dr. Samuel C. Trippe, Royal Oak, Maryland, informs the writer that he formerly had in his possession notes of lectures delivered by Dr. Hayden. These were taken in class by a relative of his. . . . Dr. Nicholas Hammond who graduated from the University of Maryland in 1823. . . . Dr. Willis H. Baxley writing from London to Dr. R. B. Winder refers to the subject as follows: "Dr. Horace H. Hayden delivered to a few medical students of the University of Maryland some lectures on Dental Physiology and Pathology. *I was one of his class.*" [He graduated in 1824.] . . .
>
> These lectures were interrupted in 1825 by the deplorable state of internal strife into which the School of Medicine was plunged . . . a legal battle between the Regents of the University and a newly created Board of Trustees which was continued until 1837 . . . at which time the Regents regained control of the University, and, it is said, Hayden resumed his lectures.

Several papers on dental subjects, to which some referred as "lectures," were

12. Footnote 1, second reference, p. 526.

13. Harris, C. A.: Dictionary of Dental Science, Biography, Bibliography and Medical Terminology, Philadelphia: Lindsay and Blakiston, 1849.

14. Harris, C. A.: Am. J. D. Sc., 2d ser., 1:401, 1851.

15. Footnote 1, second reference, p. 572.

read in 1835 before the second annual meeting of the Society of Surgeon Dentists of the City and State of New York, and doubtless they were followed by others at subsequent meetings of this association, down to 1839.[16] The first lectures to students in a dental college were given by the Faculty of the Baltimore College in the Session of 1840-1841, and many papers were read before the American Society of Dental Surgeons, beginning with the second annual meeting in 1841.

Both the obituary and Taylor seem to be somewhat in error as to the time that John Harris began to practice dentistry exclusively; for a comparison of his three earliest advertisements discovered by Mills[17] indicates that the true date is 1829 or 1830. In the third of these advertisements, published in the latter year, John Harris announces himself only as an itinerant surgeon dentist. The first advertisement, running from Nov. 1 to Dec. 6, 1827, contains the following statements:

"Medical Instruction. Dr. J. Harris of the village of Bainbridge, Ross County, is making a variety of preparations and arrangements for the instruction of a private class of Medical Students, preparatory to their entering a Medical College. . . . He will deliver lectures during the winter season, at least once a week on the following branches, viz., Demonstrative Anatomy, Operative Surgery and Chemistry, and during the summer season, he will devote as much of his time in lecturing on Osteology, Physiology, Materia Medica, Theory and Practice of Medicine and Obstetrics, as his professional avocations may permit. . . .

No dental "branches" are here mentioned, but doubtless would have been included had any been contemplated; and there is no evidence that these proposed medical lectures were delivered, the fact that they were advertised only for five weeks apparently indicating that the project was abandoned because the advertising brought no students or not a sufficient number. Neither Taylor nor anyone else says anything of such lectures, nor is there any evidence that John Harris lectured to his "three or four" medical students (mentioned by Taylor), who appear to have been with him in 1825-1827, before the advertisement under consideration was published, first on Nov. 1, 1827.

In the second of the three advertisements mentioned above, which ran in a Chillicothe paper from February to December, 1828, but is dated at Bainbridge, John Harris announces to the citizens of the latter place that he has just received a large supply of surgical and dental instruments, and that he performs all operations of dental surgery. As this announcement is to the citizens of Bainbridge, there can be little or no doubt that John Harris was still practicing medicine and surgery as well as some dentistry in that village at least as late as the close of 1828. There seems to be no justification for Mills' assumption that the statement relating to the surgical and dental instruments "would indicate that he [John Harris] had installed an additional outfit for his students," and that "the subsequent portion of his announcement was probably intended to attract patients for the dental clinic that he was establishing, in which to give technical instrution to his students. This [says Mills] is a reasonable presumption, since he had been practicing for at least seven years, and no doubt had a sufficient armamentarium for his private practice."[18]

16. Footnote 8, pp. 937, 938, 942.

17. Footnote 1, fourth reference, pp. 369, 371.

18. Footnote 1, fourth reference, p. 370 (compare p. 376).

There is no proof that John Harris ever established or proposed anything in the way of a "dental clinic"; and Mills does not seem to be justified in referring, as he does repeatedly, to a "school" that John founded and conducted at Bainbridge.[19] In one place, Mills says: "John Harris (1798-1849) was the founder of the School of Medical Instruction," thus apparently inventing a name for the suppositious institution (p. 378). Again, he has it that the "John Harris School of Medical Instruction" (all in capitals) was founded in 1827 (p. 367), the year in which the proposed medical lectures were advertised; but elsewhere Mills tells us that this "school" was in full operation in 1826-1828, and was still in existence in 1829 (p. 370).

Mills also says: "Owing to the absence of data, it is impossible to estimate the number of students enrolled at Dr. Harris' school, or what percentage of them, intent on the practice of medicine, became more interested in dental surgery. In fact, the latter class is the only one of which we have information, which indicates that preparing students for the practice of dentistry was Dr. Harris' chief motive" (p. 370). This conclusion is not only unacceptable in itself, but there is convincing evidence against it in the first advertisement as quoted above. Moreover, there is no proof that John Harris ever had any student who came to him primarily for instruction in dentistry, with the possible exception of his brother James H. Harris.

Chapin A. Harris, the other brother, in the first edition of his "Dictionary" has a biographic sketch of James H., in which he tells us that the latter, while practicing medicine, determined to qualify himself for dentistry; availed himself of such information as he could from books; received "some instruction from his brother, Dr. John Harris" (probably to 1826); began occasionally in 1827 to operate on the teeth, and soon relinquished medicine, devoting his whole time to dentistry. This sketch is unnoticed by Mills, who gives an unsatisfactory reason for his supposition that James H. Harris studied dentistry in the medical "school" of John in 1827-1828[20]; but there is no evidence that James received even his preliminary medical instruction from John; whereas, the reverse is possible, James being the elder. In his "Dictionary," Chapin A. Harris also has a sketch of the dentist Edward P. Church, who is there said to have spent the last two years of his preliminary medical studentship "under the tuition of the author and his brother Dr. John Harris," and to have devoted a considerable portion of that time to dental surgery (perhaps only with John). It is quite probable that Church is the unnamed individual whom Taylor couples with himself as having learned something of dentistry during their medical studentship with John Harris at Bainbridge. There is no proof that any others did so.

Both Mills[21] and Weinberger[22] follow Thorpe's biography of John Allen in stating that he was a student of dentistry with John Harris at Chillicothe in 1829-1830. But this is probably an error, for while Thorpe closely follows the phraseology of "A Biographical Sketch of Dr. John Allen"[23] and his obituaries,[24] these three records state that Allen became a student of dentistry with James Harris at the age of nineteen (which he reached

19. Footnote 1, fourth reference, pp. 368, 370, etc.

20. Footnote 1, fourth reference, p. 376.

21. Footnote 1, first reference, p. 107; fourth reference, p. 370.

22. Footnote 1, third reference, p. 1074.

23. D. Reg., 28:141, 1874.

24. Internat. D. J., 13:310, 1892; D. Cosmos, 34:408 (May) 1892.

Nov. 4, 1829), and began practicing that profession in Cincinnati in 1830. And as Mills gives us an advertisement of James H. Harris, showing that he practiced dentistry in Columbus, Ohio, in 1830[25] in all probability it was he rather than his brother John who was the preceptor of John Allen for a short time.

As to Chapin A. Harris, he became a medical student with John at Madison, Ohio, about 1824 (according to the obituaries of the former as followed by Thorpe), and practiced medicine at Greenfield, where he began the study of dentistry in 1828, when John Harris and Taylor did some dental operating in his office, according to Taylor. There is no proof that Chapin A. Harris took any course of dental instruction with John, or was ever with the latter at Bainbridge; nevertheless Mills lists Chapin A. Harris as a graduate of the "John Harris school at Bainbridge."[26] Thorpe appears to be substantially correct when he says that the attention of Chapin "was called to the possibilities of Dentistry by his brother John [in 1828]," adding:

> Chapin began the practice of dental surgery in Greenfield in 1828 by extracting, cleaning teeth and inserting a few fillings. Not satisfied with the meagre knowledge he possessed, he secured the books of Delabarre, Fox, Hunter and the other recognized authorities, and soon acquired a thorough knowledge of the profession in which he became so eminent. He remained in Greenfield about a year and then moved to Bloomfield, Ohio, where he [still] combined the practice of Dentistry with Medicine and Surgery for two or three years.

It is probable that he then went directly to Baltimore, immediately or shortly thereafter devoting himself exclusively to dentistry; for his surviving daughter has letters from him to his wife proving that he established his dental headquarters and family residence in that city in 1831, and for the next ten years also practiced as an itinerant dentist during part of each year in several cities of the South.[27] There can be little doubt that at the beginning of his career in Baltimore, he took a regular course of dental instruction with Horace H. Hayden; for E. F. Cordell tells us that Chapin A. Harris was a "Pupil of Dr. H. H. Hayden."[28] Simon says that "Hayden's attempt to teach scientific dentistry by a course of lectures [in the University of Maryland, 1837-1838, and doubtless earlier] was the starting point for the founding of the college a few years later,"[29] but there is some evidence that Chapin A. Harris received the direct inspiration for the Baltimore College while on a visit to New York City; for J. B. Rich states:

> Dr. Solyman Brown was the one who suggested "Why not have an independent Dental College," when the meeting of prominent dentists in New York took place, when Chapin A. Harris was on from Baltimore to get a Chair of Dentistry in one of the medical colleges. The suggestion was seconded by Dr. Jahial Parmly, the cue was taken and Dr. Harris returned to Baltimore and started the Baltimore College of Dental Surgery."[30]

Therefore, it seems that we cannot accept Mills' scheme in which the Baltimore College is directly stemmed from the suppositious "school" of John Harris at Bainbridge.[31] As the Baltimore College was the first, it seems more reasonable to stem all other dental colleges from

25. Footnote 1, fourth reference, p. 377.
26. Footnote 1, fourth reference, p. 384.
27. Brown, L. P.: Sketch of Chapin A. Harris, Dictionary of American Biography, New York City: Charles Scribner's Sons, 1928; ibid., Sketch of Horace H. Hayden.
28. Cordell, E. F.: M. Ann. Maryland, p. 429.
29. Simon, William: History of Baltimore College of Dental Surgery, Tr. 4th Internat. D. Cong., 3:294, 1904 (reprint, p. 8).
30. Footnote 6, p. 947.
31. Footnote 1, pp. 367, 384.

that, rather than accept Mills' stemming of a Western line from the Bainbridge "school"; this line beginning in 1845 with the Ohio College of Dental Surgery, of which James Taylor is assumed to have been the originator or chief promoter. Taylor was merely the first professor of practical dentistry in the Ohio College, while its first dean was Jesse W. Cooke (honorary D.D.S., Baltimore College, 1844; first President of the Mississippi Valley Association of Dental Surgeons, while Taylor was its first corresponding secretary, 1844); wherefore, it is not improbable that Cooke was the originator and chief promoter of the Ohio College and that he received his inspiration from the one in Baltimore.

John Harris seems to have published nothing on dentistry or on any other subject, before 1835-1836, when his first dental articles (for the laity) appeared in a newspaper, the *Kentucky Commonwealth,* according to his obituary, which is partially confirmed by the fact that Weinberger has found one such article, designated as No. II, in the *Commonwealth* of Frankfort for March 25, 1835, which he reproduces in full.[32] Dental papers of a more technical character had previously been published in medical journals[33] and John Harris evidently drew on such journals as well as on his own observations when preparing the *Commonwealth* articles. Some of his statements in the article found by Weinberger evince an inquiring and judicious mind, but no special scientific knowledge of dentistry, even as taught in his day.

The only contributions to dental literature from the pen of John Harris appeared in the *American Journal of Dental Science,* 1844-1846. The first is "On the Utility of Filing the Teeth,"[34] in which the author strongly advocates the old and unscientific system of filing away the approximal tooth surfaces (as previously advised by him in the recovered *Commonwealth* article). Next comes a letter entitled "Is the Negro Subject to Harelip?"[35] the writer holding that he is not. Then we have "Removal of a Drill-head from the Cavity of a Tooth by means of a Magnet,"[36] followed by "Dissertation on Tooth-ache,"[37] read at the 1845 meeting of the American Society, which seems to have been the first dental meeting attended by John Harris. In the "Dissertation" he advocates that "diseased teeth" be extracted rather than treated, in the majority of cases, because, with the treatment of his time, the malady had often become "the cause of other, and sometimes more formidable diseases. . . ." He continues: "The records of medicine furnish numerous examples . . . where every remedy had been tried . . . without success. Cures had been speedily and permanently effected by the removal of diseased teeth, even when they have not been productive of pain, or suspected as the cause of the mischief. Many cases have fallen under my own observation." Referring to these remarks, Mills says: "The authentic fact remains that the edict against pulpless teeth that has so perturbed the dental profession since 1910 [when it was published by William Hunter] is but a revival of the ideas promulgated by Dr. Harris."[38] But these ideas certainly did not originate with him, his

32. Footnote 1, third reference, pp. 1078-1080.

33. Footnote 1, second reference, p. 566.

34. Harris, John: Am. J. D. Sc., 5:42-48, 1844-1845.

35. Harris, John: Am. J. D. Sc., 6:58-59, 1845-1846.

36. Harris, John: Am. J. D. Sc., 6:87-88, 1845-1846.

37. Harris, John: Am. J. D. Sc., 6:100-110, 1845-1846.

38. Footnote 1, first reference, p. 108.

own words indicating that he derived them from medical journals and confirmed them by his own observations. His last article, entitled "Observations on the Evils Resulting from the Premature Application of Artificial Teeth on Plate with Clasps," etc.,[39] elaborates statements on the same subject in the recovered *Commonwealth* article. There is no reference to any dental authority in the known articles by John Harris, nor do they indicate that their author possessed any remarkable originality or scientific knowledge. Neither is he known to have published any book or pamphlet, to have devised any improved methods or appliances, or to have suggested a dental journal or dental society.

Nevertheless, Weinberger[40] says that "the title given by Thorpe to Horace H. Hayden, 'The Father of American Dental Science,' should now be bestowed upon John Harris, the preceptor of the founders of the first two dental colleges and the first dental journals in the East and the West," these publications being the *American Journal of Dental Science* and the *Dental Register of the West;* and we also have "John Harris, the Father of American Dental Education" in the title of one of Weinberger's articles[41]; but even if there is such a thing as American dental science as distinct from European dental science, it certainly did not originate with any one man; and the same may be said of dental education. Evidence has been presented above that Hayden has the best claim to preeminence as a teacher of dentistry during the two decades immediately preceding the establishment of the Baltimore College, and his early scientific knowledge of dental and oral subjects is evident from his "Ulcerated Tonsils" in the *New York Medical Repository* for 1804; and his "Investigation on the Nature, Growth and Formation of the Teeth" in the same journal for 1826.

Weinberger's title, "The Father of American Dental Education," given to John Harris in 1929, is in accordance with the inscription on a tablet erected at Bainbridge by Mills and his brother in 1925; for there we have: "Bainbridge, Ohio, The Cradle of Dental Education," so recognized because "Here, in 1826, under the preceptorship of his brother Dr. John Harris, Chapin A. Harris with James Taylor received instruction in medicine and dentistry."[42] But there is no proof that Chapin A. Harris took any course of dental instruction with John, or was ever with him at Bainbridge; and the former studied medicine with the latter at Madison about 1824, as stated above.

Mills' article, entitled "Bainbridge, Ross County, Ohio, the Cradle of Dental Education,"[43] is a lengthy attempt to justify his untenable conclusions that "dentistry, as far as professional training is concerned, had its birth in the little village of Bainbridge, Ohio, in the year 1827," and that "dentistry, as a science, had its beginning in the village of Bainbridge in the year 1827" (pp. 361, 380). That year was evidently substituted for the 1826 of the tablet in an effort to make the birth of dentistry coincide exactly with the establishment of the supposititious "school" of John Harris at Bainbridge.

39. Harris, John: Am. J. D. Sc., 6:282-287, 1845-1846.

40. Footnote 1, second reference, p. 574.

41. Footnote 1, third reference.

42. Footnote 1, fourth reference, p. 381; Unveiling of Tablet to Drs. Harris and Taylor, Ohio Archaeol. and Hist. Publ., 35:380-401, 1926, and J. A. D. A., 13:276 (Feb.) 1926.

43. Footnote 1, fourth reference.

In connection with his general thesis, Mills accepts as "significant" (p. 368) a fanciful suggestion by Jonathan Taft in his obituary of Edward Taylor,[44] as follows: "I was born near Bainbridge, which place might properly be called the starting point of the following pioneers of the profession in the Mississippi Valley: Drs. John, James and Chapin A. Harris; Dr. Jones, formerly of Dayton, Ohio; Dr. Wampler of Illinois; Dr. Church of Baltimore; Drs. Joseph, James and Irwin Taylor." But of these men, only James Taylor, Edward P. Church and James Harris seem to have taken any course of dental instruction under John Harris, as we saw above.

Mills also concludes that Bainbridge is the place where "the vitalizing impulse to dental education," furnished by John Harris, "marked the first advance of dentistry to the rank of a profession," (p. 368), and that John Harris "did more for the educational advancement of dentistry than had been accomplished in all the ages that had preceded him" (p. 381). Surely, no comment on these statements is necessary. In fact, there seems to be nothing in evidence to wholly justify even Weinberger's more conservative statement that "John Harris played a most conspicuous part in the educational evolution of the dental surgeon in America[45]; but he certainly played a part in that evolution, honor for which should not be denied him.

44. D. Reg., 22:91, 1868.

45. Footnote 1, third reference, p. 1074.

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Editorials

WHAT THE AMERICAN DENTAL ASSOCIATION DOES FOR ITS MEMBERS

There are comparatively few of our members who are conversant with the services that are being rendered by the Association. The ramifications of the organization are more extensive and significant than the rank and file realize, and it may be enlightening to call attention to certain of our major activities whereby a very definite and constant contribution is being made to the advancement of our own members, and incidentally to the welfare of the entire profession. Whatever elevates the Association must raise the standard of dentistry as a whole, and therefore the influence of this organization must be paramount if our profession is to achieve and maintain a distinguished status in the estimate of the world. In this view of the case, is it not logical to suggest that greater pride should be taken in the achievements of the organization than is being shown by the membership generally?

Permit us to refer briefly to some of the outstanding activities that are being carried on through the agency of the American Dental Association and see if somewhat of definite value cannot thereby accrue to each member of the organization.

First is the information available through the Secretary's office on all matters of administrative policy, the *modus operandi* of dental society organization and the various problems that are presented in association management. This is particularly valuable to the officials of the component societies and thereby the machinery may come to function smoothly and efficiently.

Then there is the service rendered through the medium of dental health education under the Bureau of Public Relations, through which information is available on all matters pertaining to lectures to the laity, articles for the lay press, radio talks or anything having to do with the furtherance of mouth hygiene. Here we have a service of the greatest importance.

For the dispensing of literature on all conceivable sorts of subjects, we have the Library Bureau, which contains books of every kind dealing with the profession, and even some treating of allied topics. These books may be borrowed by our members and may also be purchased from the Library. The service having probably the greatest value is the one embraced in the distribution of what are known as the package libraries. Articles on any given subject are clipped from periodical dental literature to the number of twenty or thirty in each package, and these are bound together and made available for lending to our members at a minimum fee to cover the cost of transportation. To indicate the extent of this service, it is only necessary to state that there have been compiled to date and are available for distribution about 700 of these packages, covering 300 subjects. This service is being more widely recognized all the while and in itself is worth more than the entire dues of the Association.

The work of the Research Commission, notably that associated with the Bureau of Standards, is presented at our annual meetings through the medium of reports and papers and published in our official organ, which goes to every member of the Association. In addition to the work done in the Bureau of Standards, there are

various grants made to other research workers, the results of which are printed for the benefit of our members.

The Council on Dental Therapeutics was organized for the purpose of investigating proprietary products of interest to the profession and the public, of regulating harmful or unworthy products and of making constructive suggestions as to the betterment of those drugs and remedies used by the dental profession. Reports are published each month.

The Relief Commission functions for the benefit of infirm or unfortunate members of our Association who are without the means of support and unable to work. Through cooperation with state and local societies, substantial aid has been given by our Association to a large number of worthy and helpless members who, without this assistance, would in many cases have suffered actual want. This service is financed by the income from the Relief Fund, which is augmented each year by the sale of Christmas Seals. This activity should make a strong appeal to every one of our members with human sympathies.

Another service is rendered through the medium of group insurance to our members, who can thereby secure insurance at a premium lower than the regulation rates. This is a service that has made a strong appeal to many of our members, and the success of the plan has been amply demonstrated. Through this medium, protection has been given to many who otherwise would not have been able to secure it.

Space will not permit a more detailed description of our various activities at this time, but at least mention should be made of the Judicial Council, under which head comes for adjustment all of those questions having to do with the ethical standards governing professional conduct as embodied in our Code of Ethics.

Finally, there comes to every member the monthly visit of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION. This publication in itself is worth more than the dues of the Association. In the volume and character of the material presented, it provides a monthly and annual output of dental literature that could not be purchased elsewhere for double the amount of the annual dues.

Each year, more than 2,000 pages of printed matter, all having a bearing on dental affairs, are presented for the edification and entertainment of the members, embodying the very latest in dental thought.

Some time in the future, we may amplify on the various departments of THE JOURNAL and show wherein they are most valuable, but at this time we wish briefly to call attention to a certain service to the profession that is seldom considered. This relates to the value of the advertising pages in THE JOURNAL. For the busy, practical man, there is provided in our advertisements a wealth of material that is of the greatest value, all presented in a plain and understandable way that makes it easily available to our readers.

All in all, it is well to visualize at times the manifest desirability of membership in the Association, in which connection we may venture to make an appeal to all nonmembers to join an organization that provides so much in the way of service for such a small amount in annual dues.

OUR COUNTRY

Isn't it about time that some one had a word to say in behalf of this country of ours? Everywhere in our periodical literature, in the daily press, in magazine articles, in books, in pamphlets, even in our professional publications, there seems to be an undercurrent of belittlement whenever this country is under consideration. Apparently, it is easier for our writers to complain than to commend; and our speakers have much to say about the limitations of America, about the terrible state of affairs into which the United States has fallen, about the moral disintegration, the loss of ideals, the ascendancy of crime, the worship of mammon, and all the rest in a very dismal category.

To read our current literature and to listen to our lecturers, one would imagine that this country was going straightway to the dogs, and that nothing could save it. No word of denunciation is strong enough, no insinuation is subtle enough to cast discredit on the nation when a few malcontents are let loose with pen and tongue. To take

all of these lugubrious utterances at their face value would soon throw us into the slough of despond and make us blush for this fair land of ours; but these utterances should not be taken at their face value and we are not called on to blush for our country.

It is true that, in the rapid evolution of our activities, many abuses have crept in and some unwisdom has been shown. Never before in the history of the world has there been an example of such unparalleled progress as has marked the development of this country. In a century and a half, this nation emerged from a wilderness into a veritable paradise of peace and plenty, and from a struggling nucleus of a few tottering colonies into one of the great outstanding nations of the earth.

Naturally, in all of this social and economic upheaval of energy, there have been waste products that have taken their toll and left their mark. There has been not a little misjudgment, and some dereliction of duty. Discrepancies in behavior have crept in and crudities of conduct; but, fundamentally, this country is at its core as sound as the eternal truth and as stable as the everlasting hills.

To say nothing of its industrial and scientific achievements—with which there has never been anything in the world to compare—we have seen manifest an expression of individual and collective happiness and welfare never before approached by human kind. Go into the homes of the people from one end to the other of this broad land of ours and note the evidence of comfort, the evidence of refinement, and even of culture. If the home is the unit of our civilization, America may well claim a worthy status in the grade of civilization the world over. In even the humbler homes of this country, there are privileges enjoyed by the people that are unheard of by the countless hordes of other nations with a history dating back centuries before ours. Is it not meet that we appreciate our privileges, rather than to continually emphasize our limitations and magnify our sins?

Sins we have to be sure, too many of them, but they are mostly sins of omission rather than of commission. We sin more in the indifference to evil than in the commitment of evil—more in evasion than in overt act. There are too many crimes, and these crimes are a blot on the fair name of the nation; but this much should be said, that

most of the major crime in this country is committed by those who came direct from other countries, or at least are only a generation removed. In other words, the criminal tendencies have been for the most part imported, and our one sin of omission is that, in the past, we have not sufficiently safeguarded the character of those whom we have taken in with open arms. Even with a recognition of the patent fact that the United States has profited greatly by the influx of blood from other lands, and that the country could never have developed so rapidly without it, the fact must be faced that America has been made the dumping ground of too many of those with criminal tendencies, and that today we are suffering not only in our reputation but also in our very safety as a result. All that we need to do is to purify the stream of our emigration, and to deport every one of those who blatantly berate our country and sneer at our institutions; and this should apply to men of all degrees, from the bloodthirsty reds in our back alleys to the more subtle and insidious but no less pernicious pinks among some of the professors in our universities. The moment an individual incites trouble in this country by flouting the principles on which this nation was founded, by undermining at least by inference the Declaration of Independence and the Constitution of the United States, he should be classed at once as an alien enemy and treated as such. Freedom of speech is vouchsafed by every intelligent nation, but the insidious propaganda that is too often spread for the purpose of inciting discord and class hatred among Americans is not so much freedom of speech as it is the license of unbalanced brains. If all the agitators who are declaiming against the United States today, and all the criminals who are breaking our laws were placed in our lunatic asylums and kept there till they are cured, it would be better for everyone—better for the country, for the world at large and especially for the agitators and criminals themselves.

The house cleaning that we most need today relates not any more to the cure of our physical ills than to the cure of our mental ills, and, in the ultimate, it relates not so much to cure of any kind as it relates to prevention. The fair and logical way to prevent many of our ills is to deport our agitators. We should aim to be fair to every individ-

ual and as logical as we may. Can it be considered illogical when a man is dissatisfied with a country to permit him to go to another, or is it unfair when we insist that he must go?

CHARLES H. GIETZEN, D.D.S.

(1876-1932)

Charles H. Gietzen was born at Fremont, Nebr., Aug. 2, 1876; died at Emmanuel Hospital, Omaha, Nebr., May 4, 1932. He was the son of Henry and Louisa Gietzen. He secured his early education at Humphrey, Nebr. In 1897, he matriculated at the Omaha Dental College. The following year, he transferred to the Northwestern University Dental School, at Chicago, graduating in the spring of 1905. He settled at Columbus, Nebr., where he practiced four years, and then moved to Omaha, taking over the practice of Frank Wilson (deceased).

In 1919, Dr. Gietzen associated himself with Herman A. Maves. In 1924 he returned to Omaha, where he continued in practice until the time of his death.

Dr. Gietzen, who possessed eminent qualifications for teaching, was on the faculty of Creighton University Dental College as a teacher in crown and bridge work. He was frequently called on to lecture on this subject before dental organizations all over this section of the country.

He believed thoroughly in dentistry, was most conscientious and enthusiastic in his work and did much to raise to a higher plane the standard of dentistry throughout the country, particularly in his own section. The predominating characteristics of his personality were his earnestness, enthusiasm and conscientiousness in promoting dentistry as a health service. His death is a serious loss to the profession and one that will be mourned by all who knew him.

His ability was not confined to his chosen profession alone. Beauty of soul and of nature and the love of outdoor life often found expression in his compositions. In both prose and poetry, he had recognized talents and he contributed much to dental literature. He was the historian of Delta Sigma Delta for Nebraska.

Dr. Gietzen was president of the Omaha District Dental Society in 1928 and a past grand master of Delta Sigma Delta fraternity. He was a member of the Omaha lodge No. 288, A. F. and A. M., the Scottish Rite Masons, the Shrine and the Shrine Patrol.

Surviving are two sons, Carrol D. and Charles H., Jr., and one daughter, Betty Lou, two brothers and two sisters. His wife died four years ago.

Funeral services were held at the Scottish Rite Cathedral, Omaha, May 7, with interment at Forest Lawn.

GEORGE M. BOEHLER.

COUNCIL ON DENTAL THERAPEUTICS

BISODOL—NOT ACCEPTABLE FOR A.D.R.

The Council has considered BiSoDol. After this report was adopted by the Council, it was sent to the firm manufacturing BiSoDol by registered mail. No reply having been received, the report was authorized for publication for the information of the profession and the public.

SAMUEL M. GORDON, *Secretary.*

About three decades ago, the promoter of drugs had no food and drugs act to contend with, the consumer had no protection and outrightly false statements of composition and therapeutic claims were rampant. With the modicum of protection afforded by the Food and Drugs Act and the series of pointed exposures of the American Medical Association, promotion of the "ethical" proprietary has become a little more hazardous. Whereas, three decades ago, imaginary chemical compounds were common and outrageously false statements for cures were made, today science is "played up" in advertising, whether to the public or to the public through the physician or dentist, and thus a somewhat dignified air is given to otherwise common or irrational mixtures.

BiSoDol, put out by the BiSoDol Company, of New Haven, Connecticut, is said by its manufacturers to be an "ethical" preparation, supposedly because it is not advertised in newspapers or lay magazines but only in certain so-called professional journals, both medical and dental, whose advertising standards are not based on scientific considerations. Whether a product intended for direct over-the-counter sale is advertised directly or indirectly to the public is of no consequence, for it is appreciated that once the public becomes familiar with a trade name and the conditions in which the preparation is recommended, either through statements of an ill-advised medical or dental practitioner, or through lay gossip, there is no law or force at the present time that can prevent the purchase. This leads to the age-old story of self-medication and its consequences. In many cases, to be sure, the condition passes because of the play of Nature's forces; in other cases, a false sense of security or the loss of time in securing adequate diagnosis or competent care for any of the number of indications coming under "stomach trouble" often leads to graver and more serious conditions.

WHAT IS BISODOL?

BiSoDol is stated on the principal container to offer "A rational and effective method of re-establishing the normal alkalinity of the body without danger of systemic disturbance." No statement of composition other than "The presence of Malt Diastase and Carica Papaya Compound makes it valuable in digestive disturbances," appears on the container. In advertising issued to dentists, it is stated to be "composed of Sodium Bicarbonate and Magnesium Carbonate, Bismuth Subnitrate, the amylolytic enzyme, Diastase, the proteolytic enzyme, Papain and Oil of Peppermint."

BiSoDol is stated to be a "balanced combination of alkalis which can be depended upon to meet safely the needs of alkaline medication. . . . an effective agent, not only in

combating the more pronounced conditions of acidosis and hyperacidity but for replenishing the depleted alkali reserve." "The combination of Sodium Bicarbonate and Magnesium Carbonate," it is claimed, "corrects abnormal acid conditions with safety and effectiveness." It is stated that "Bismuth Subnitrate has long been used for its astringent and sedative action on the gastric and intestinal mucosa and to alleviate dyspeptic conditions, while the beneficial results of Papain in the treatment of dyspepsia and gastric catarrh are well known." It is advertised to physicians and dentists for "hyperacidity," "gastric or duodenal ulcer," "digestive disturbances," "anesthesia," "common colds," for nausea of pregnancy, and as part of an antacid diet, for hyperacidity in gallbladder disease, seasickness, after alcoholic indulgence, for correction of acidosis in obesity, for urticaria, for hyperacidity in relation to dental caries, for pyorrhea, gingivitis, salivary calculus, after extractions, for correction of digestive irregularities while awaiting dentures, and as a mouth wash.

Clinical samples, of course, are available in handy little cans for direct distribution to patients.

Some of the foregoing claims appear in advertising in so-called professional journals.

In view of the circumstance that a frank statement of composition does not appear in the advertising or in the literature, the product was examined in the A.D.A. Bureau of Chemistry. The report of the Bureau follows:

Two (2) original packages of BiSoDol (The BiSoDol Company, New Haven, Conn.) were received for examination.

The container was not labeled.

The following appeared on the carton.

BiSoDol, Antacid—Digestant. Dose—one teaspoonful in water after meals as indicated. Manufactured by the BiSoDol Company, New Haven, Conn., U.S.A. Average net weight 2 ounces.

Offers a rational and effective method of re-establishing the normal alkalinity of the body without danger of systemic disturbance.

The presence of Malt Diastase and Carica Papaya Compound makes it valuable in digestive disturbances.

Each package contained approximately 58 gm. (approx. 2 ounces) of a white powder, possessing an odor of peppermint and a saline taste.

The powder was partially soluble in water and the solution gave an alkaline reaction to litmus. Effervescence was noted on the addition of dilute hydrochloric acid, and the powder was almost completely dissolved. The insoluble residue consisted of a few shreds of material.

Qualitative tests indicated the presence of bismuth, sodium, magnesium, carbonate and nitrate. Starch and protein containing substances were indicated in small amounts. A trace of iron was also indicated. Other heavy metals, potassium, chlorid, bromid, iodid, phosphate and sulphate were not found.

Quantitative examination yielded the following:

Loss in weight (over H_2SO_4)	0.6 per cent
Ash (600 C.)	54.5 per cent
Bismuth (Bi^{+++})	1.08 per cent
Magnesium (Mg^{++})	10.00 per cent
Sodium (Na^{+})	15.5 per cent
Carbonate (CO_3^{--})	59.6 per cent
"Silica"	0.04 per cent

"R_2O_3" ..... 0.10 per cent
14.8 c.c. normal acid required to neutralize 1 gm.

On the basis of the foregoing, a mixture having the essential composition of BiSoDol may be expressed as follows:

Bismuth subnitrate, U.S.P..... 1.5 parts
Magnesium carbonate, U.S.P.....42. parts
Sodium bicarbonate, U.S.P.....56. parts

To which add a small amount of oil of peppermint and protein material.

From the foregoing, it may be calculated that an average single dose (1 teaspoonful, 4 gm., 1 dram) would contain: 0.06 gm. (1 grain) bismuth subnitrate, U.S.P.; 1.7 gm. (26 grains) magnesium carbonate, U.S.P.; and 2.24 gm. (35 grains) sodium bicarbonate, U.S.P.; and each daily dose would contain: 0.18 gm. (3 grains) bismuth subnitrate, U.S.P.; 5.1 gm. (90 grains) magnesium carbonate, U.S.P., and 6.6 gm. (108 grains) sodium bicarbonate.

Based on current wholesale prices, in one pound lots, the cost of the ingredients in 2 ounces of a mixture containing 1.5 parts bismuth subnitrate, U.S.P., 42 parts magnesium carbonate, U.S.P., and 56 parts sodium bicarbonate, U.S.P., would be approximately three cents.

According to the chemists report, BiSoDol is essentially three parts of magnesium carbonate and four parts of baking soda to which a little oil of peppermint has been added. The amount of bismuth subnitrate in a single dose, approximately one-fifteenth of the average daily dose, is so small that for all practical purposes it might as well be omitted.

The action of the amounts of diastase and papain present in BiSoDol and which may be expected to be taken into the alimentary tract would certainly be slight. Hence, unless definite evidence to the contrary is produced, it may be concluded that their action under conditions found in the alimentary tract would certainly be of no consequence. BiSoDol will, therefore, do no more, no less, than a mixture of three parts of magnesium carbonate, U.S.P., and four parts of sodium bicarbonate, U.S.P. (baking soda).

THE SCIENTIFIC BACKGROUND FOR BISODOL

BiSoDol is given a "scientific" air by frequent references to various research workers, although an examination of some of the reports mentioned shows no reference to medication with a mixture even roughly approximating BiSoDol in composition. One of these pieces of advertising distributed at dental conventions passes under the title "Balance." The references in the booklet are authentic, but that the application to BiSoDol is unwarranted and misleading is apparent on examination of the quoted references.

Much of the information bolstered by references to scientific journals is offered to show that administration of sodium bicarbonate leads to alkalosis. This is supported by quotations from editorials which appeared in the *Journal of the American Medical Association* and by reference to work in other reputable medical journals. One of the papers quoted or referred to is that of Kast, Myers and Schmitz,[1] who showed that excessive intakes of sodium bicarbonate led to alkalosis, but also that this was one of

1. Kast, L.: Myers, V. C., and Schmitz, H. W.: J.A.M.A., 82:1859 (June 7) 1924.

several causes, pyloric obstruction being also a common cause. Obviously, alkalosis due to pyloric obstruction would be made worse by ingestion of sodium bicarbonate, and it is apparent from the chemist's report that a dose of BiSoDol contains more sodium bicarbonate than the dose of the latter recommended for heartburn, for example. The misleading use of these quotations in this advertising is further illustrated by a careful reading of the article by these authors, who state that their findings indicate the data on both the p_H and on the bicarbonate values in the blood to be necessary to secure an adequate index of the acid-base balance. Yet BiSoDol may be purchased directly by the public for self-medication without this necessary laboratory aid for diagnosis. Again, the blanket dose recommended on the can is "one teaspoonful in water after meals as indicated," whether the condition is simple heartburn or gastric or duodenal ulcer, or dental decay in pregnancy.

HOW BISODOL INCREASES THE TENDENCY TO ALKALOSIS

The blanket directions for the use of BiSoDol, either as an antacid or as a digestant, are given on the container as "one teaspoonful in water after meals as indicated." Reference to the report of the chemist shows that a single dose of BiSoDol (4 gm.) would contain, aside from bismuth subnitrate, which is far from a therapeutic dose, as already pointed out, magnesium carbonate, U.S.P., 1.7 gm. (26 grains) and sodium bicarbonate, U.S.P., 2.25 gm. (35 grains). If it is deemed advisable by a physician to prescribe sodium bicarbonate for hyperacidity three times a day before meals, the dose, according to certain authorities, should be about 0.5 gm. (7½ grains) and a daily dose would be 1.5 gm. (23 grains). One dose of BiSoDol would furnish not only this amount, but 12 grains in addition, not to mention the alkalinizing effect of the magnesium carbonate. Hence, it is apparent that instead of lessening the tendency to alkalosis because of induced amounts of alkali, the tendency becomes even greater.

CONCLUSION

It is not to be denied that either sodium bicarbonate, magnesium carbonate, alone or a mixture of these in proper proportions, is beneficial in certain cases. Properly used, they are of value and, when indicated, they are readily and easily prepared by any pharmacist; but a blanket prescription to cover the range of conditions mentioned is not conducive to sound therapy nor in the interests of the public.

The Council cannot admit BiSoDol to A.D.R. because a statement of composition does not appear on the label (Rule 1); it is advertised to the public through the dental profession for self-medication in conditions which require competent and constant professional care (Rule 4); it is marketed with unwarranted, misleading and ridiculous therapeutic claims (Rule 6); because the name does not express the composition of this unscientific mixture (Rule 8), and because it is an unscientific and needlessly complex mixture, marketed in fixed dosage form and its use is therefore inimical to the best interests of the profession and the public (Rule 10).

NEU-ORA CONTACT ANESTHETIC—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, Secretary.

In the latter part of 1931, inquiries came from dentists concerning Neu-Ora Con-

tact Anesthetic (local), put out by the Neu-Ora Company, Inc., Seattle, Wash., and Vancouver, B. C. A communication was sent to the firm, asking whether the composition was secret, and, if not, whether they would care to supply a statement of the qualitative and quantitative composition. A booklet containing the rules of the Council was enclosed. To date, this letter has not been acknowledged.

In the early part of this year, the following communication was received from a dentist:

I am forwarding to you, under separate cover, a preparation distributed under the name "Neu-Ora." This preparation is advertised as a contact anesthetic and is described as non-toxic, nonirritant, with no after-effect, and retails for $2.50.

I may say, in our practice of exodontia, it has been employed very successfully in eliminating the initial puncture of the needle in conductive and infiltration anesthesia, and I feel, from our experience with the product, it might well be recommended to the profession; not only to the men engaged in the surgical aspect, but also the general practitioner where such a contact anesthetic might be found an aid in several different branches of the work.

If this preparation has not already been submitted to you for examination and report, I will appreciate your Council making a thorough analysis as to composition, effect on the mucous membranes, if any, and its possibilities as a contact anesthetizing agent in the extirpation of pulps and other possible uses in the general practice of dentistry, favoring me, in due course, with complete record of your findings.

The correspondent was informed at that time that no investigation had been undertaken in the Laboratory, but it was proposed to make an investigation because of the apparently dangerous character of the preparation. According to the statement on the label, there is in the product cocain hydrochlorid, 72 grains per ounce, alcohol, 50 per cent, and epinephrin, 1:5,000. The cocain content is therefore approximately 15.6 per cent. The correspondent was advised of the investigations of the Committee for the Study of Toxic Effects of Local Anesthetics of the American Medical Association, analyzing the fatalities from local anesthetics. Since that time, the product has been examined for cocain in the A. D. A. Bureau of Chemistry, and was found to have approximately the composition stated on the label.

Advertising states:

Neu-Ora Contact Anesthetic (Local) is the most effective contact anesthetic on the market. It is non-toxic, non-irritating, leaves no after effect, and in itself is antiseptic. Possesses deeper penetrating qualities than any known topical form of anesthetic.

Some of the uses for contact anesthetics suggested for dental use are:

Preparation of Cavities, Pyorrhea Treatment, Before Hypo Injections, Lancing Abscesses, Extracting Deciduous Teeth, Resection of Tissue, Post Operative Pain, Setting Crowns, Preparing Crowns and Inlays, Orthodontia Appliances, To Prevent gagging in taking impressions.

Thus practically the whole range of procedure in operative dentistry is included.

Advertising also carries directions for its use by eye, ear, nose and throat specialists:

Anaesthetization for: Abscesses of Ear Canal, Otitis Media, Sinus Diseases-Antrum Ethnoid, Sub-Mucus resection, Polops, Tonsillar Abscesses, Tonsils before injections, Abscesses of Eye Lids.

For the General Practitioner, it is suggested for

Anaesthetization for: Lancing Abscessed Ears, Lancing Boils, etc., Lancing Tonsils for Quinsy, Surrounding Tissue preparatory to Taking Stitches, Hemorrhoids, Growths of Organs, Venereal Diseases, Extracting Deep Seated Slivers.

Other advertising states:

Neu-Ora Contact Anesthetic is, and has been proven to be the most effective local anesthetic on the market. Has many penetrating qualities much superior to any known topical.

Detailed instructions are given "For Preparing Cavities," "For Pyorrhea Treatment," "Extracting Deciduous Teeth," "To Prevent Gagging When Taking Impressions," "Before Using the Needle," and in "Post Operative Pain" and "Lancing Abscesses." It is stated to be "In no way stimulating and does not enter the blood stream."

The following statement of composition is given on the label:

Cocain HCl 72 gr. per ounce. Alcohol 50%. Epinephrin 1/5000.

When calculated to percentage terms, it is thus seen that Neu-Ora Contact Anesthetic (local) contains approximately 15 per cent of cocain hydrochlorid, and this is in essential agreement with the results reported from the A. D. A. Bureau of Chemistry.

Before the introduction of procain hydrochlorid, cocain hydrochlorid was much used not only in dental surgery but also in local anesthetics for general surgery, and has been used for local anesthesia in tonsillectomy, application to the urethra, mucous membranes, etc. The continued observations of a number of toxic effects and fatalities from the use of cocain injected or applied topically attracted attention to its dangerous character, as compared with other local anesthetics. Its use today is limited to those conditions in which other local or general anesthetics are not suitable. It is well known that where cocain hydrochlorid is used, greater care must be exercised. This is clearly brought out in the studies of the Committee for the Study of the Toxic Effects Following the Use of Local Anesthetics of the American Medical Association.[1]

The committee pointed out the dangerous effects of cocain when applied topically in tonsillectomies in solutions containing 10 per cent or more, and suggested that if cocain solutions were to be used, the solution be kept to 5 per cent. The committee also suggested that, whenever possible, a solution of procain hydrochlorid, with the requisite amount of epinephrin, be used.

The objections that apply to the use of a 15 per cent solution of cocain hydrochlorid by swabbing prior to tonsillectomy apply to the use of a solution of such strength to the gums or to the living parts of the teeth. It is apparent that the operator who follows the directions of the Neu-Ora Company has no way of accurately gaging the amount of anesthetic applied to a particular part. It cannot be denied that a 15 per cent solution of cocain when applied topically to the gums would bring about anesthesia, but the dangers attendant on its use are too great to warrant the indiscriminate use of cocain hydrochlorid in such a concentration.

This discussion passes over the dangers of the continued use of cocain because of its habit-forming properties. The claim that Neu-Ora is nontoxic and leaves no after-effect is definitely at variance with published information concerning the effects of cocain on mucous membranes. The same is true also of the statement that "Neu-Ora is in no way stimulating and does not enter the blood stream," for many of the symptoms of cocainization point to the stimulating action of cocain on the central nervous system. The claim that no after-effect is produced is at variance with well-known facts since the habit-forming property of cocain has been one of the greatest forces against its continued general use in medicine or surgery.

1. Toxic Effects Following Use of Local Anesthetics, J.A.M.A., 82:876-85 (March 15) 1924; 90:1290 (April 21) 1931.

If the dentist or the physician desires to use a solution of cocain hydrochlorid, 15 per cent, in water or any other medium, that is within his province, provided proper registration has been made for a narcotic license under the Harrison Law.[2] If this is used or prescribed by physicians or dentists, it should be with an understanding of the potentially dangerous properties of the solution, and should be prescribed or obtained in proper form, instead of under a proprietary name which is noninforming as to the composition.

The statement that "Neu-Ora Contact Anesthetic is, and has been proven to be the most effective local anesthetic on the market," is hardly justifiable in view of the circumstance that its main component, cocain, has been almost entirely replaced by procain hydrochlorid in dental practice.

The attempt to foster the use of cocain as a surface anesthetic for almost every operation in dentistry is, to say the least, unwarranted and even dangerous, and may have the tendency to employment of careless rather than careful, painstaking operative procedure, and with anesthetics when they are not absolutely indicated. Perhaps more injury has been done to pulps in this way than the dentist is aware of.

The recommendation for its use before "Hypo Injection" deserves special comment, because of the recent tendency not only of this manufacturer, but also of other manufacturers, to introduce to the dental profession various mixtures of local anesthetics for application to the mucous membrane before puncturing with the needle or before almost all operative procedures. This activity on the part of the manufacturers no doubt arises from the commendable desire of the dental practitioner to make an operation as nearly painless as possible, from first to last. A careful reading of such advertising in general shows no suggestion that only sharp and properly beveled needles be used, or that temporary anesthesia may be induced by digital pressure. In the last analysis, a careful technic is more important than the application of an anesthetic solution, even of such a one as cocain, which may filter below the surface of the membrane and bring about temporary anesthesia. There are many conditions in which anesthesia by topical application may be useful, but this should be employed according to individual needs and conditions, instead of the practice of anesthetizing before each operation, no matter how insignificant.

If the dentist desires to use topical anesthetics for minor surgery, such may be had in the form of cocain hydrochlorid solution of not more than 2 per cent, ethylaminobenzoate in an appropriate solvent, applied some time before the needle,

2. The Harrison Narcotic Law requires that every person who produces, imports, manufactures, compounds, deals in, dispenses, sells, distributes or gives away opium or coco leaves or any compound, manufacture, salt, derivative or preparation thereof, shall register with the collector of internal revenue of the district in which he resides. Under the terms of the law, it is unlawful for any person required to register to produce, import, manufacture, compound, deal in, dispense, sell, distribute, or give away any of the aforesaid drugs without having registered and paid a special tax provided for. The law requires any physician, dentist or veterinary surgeon registered under the act to keep a record of all such drugs dispensed or distributed, except such as may be distributed or dispensed to a patient on whom such physician, dentist or veterinary surgeon shall personally attend. Thus, those dentists who are using cocain or other drugs coming within the purview of the Act are required to obtain from the collector of internal revenue in their district a license to prescribe and use such drugs in their practice. Failure to do so makes offending parties liable to the provisions of the Act.

benzyl alcohol (N. N. R.), ethyl chlorid by spray or ethylaminobenzoate in a powder, ointment or solvent for postoperative pain.

In view of the foregoing, the Council cannot admit Neu-Ora Contact Anesthetic to A. D. R., because it is advertised to the dental profession in such a way as to give the practitioner a false impression of its toxicity (Rule 3); it is advertised with unwarranted therapeutic claims (Rule 6); the name Neu-Ora is not suggestive of the composition of a mixture of well-known drugs (Rule 8); and the use of the preparation is not in the interest of the dental profession or the public (Rule 10).

The report of the A. D. A. Bureau of Chemistry follows:

One (1) package of Neu-Ora Contact Anesthetic (Neu-Ora Co., Inc., Seattle, Wash., and Vancouver, B. C.) was received for examination. The package consisted of a small bottle of liquid enclosed in a carton and accompanied by a circular.

The following appeared on the label:

Neu-Ora. Contact Anesthetic. (Local) Cocaine HCl 72 gr. per ounce. Alcohol 50%. Epinephrin 1/5000. Neu-Ora Co., Inc., 404 Arctic Bldg., Seattle, U. S. A., 995 Howe St., Vancouver, Can.

The package bore a United States Internal Revenue Narcotic Stamp.

The bottle contained 6.2 c.c. (approximately 1/5 fluid ounce) of a yellow liquid possessing a pleasant odor and an acid reaction to litmus. The refractive index at 20 C. was 1.4040. The specific gravity at 20 C. was 0.944.

Qualitative tests indicated the presence of cocain, epinephrin, chlorid, alcohol and essential oils.

Quantitative examination yielded the following:

Alkaloidal residue ..... 14.0 per cent
Cocain hydrochlorid ($C_{17}H_{21}O_4N.HCl$) ..... 14.2 per cent

From the foregoing it may be calculated that each fluid ounce of Neu-Ora contains essentially 4.2 gm. (65 grains) of cocain hydrochlorid.

BUREAU OF PUBLIC RELATIONS

THE VALUE OF THE MOUTH HEALTH PROGRAM OF THE CANADIAN DENTAL HYGIENE COUNCIL*

By HARRY S. THOMSON, D.M.D., Toronto, Canada

I wonder if there is any way of establishing the value of any health program other than by a consciousness of the fact that your efforts are bringing the joy of living to many people—by telling them the story of better health—better health that does not mean only a visit to the physician or the dentist—better health brought about through education—better health that means perhaps only changed habits of living—better health that allows every boy to occupy the sphere to which he aspires, that makes him not only a better football player or baseball player, but a better boy, in whose wholesome mind arise sane thoughts which inspire a nobler patriotism and better citizenship. Unfortunately, in some cases today this means expenditure of money, which is not always available. Is that any reason why any child should be handicapped? It is a matter of education, and education is free.

TO correctly evaluate any one phase of public health activity is a matter of some difficulty, because of the interlocking and interdependence of all phases with one—better health.

Facts and figures have been presented from time to time which have proved, very forcibly, the full value of the work done in many phases of preventive medicine, and the good accomplished by the educational work carried on along their particular lines. Perhaps the best evidence of its value in preventive medicine is the lower death rate shown in the tables on maternal mortality and infant mortality, the lessening in the incidence of tuberculosis, and, in a very striking way, the reduction of the number of cases of typhoid fever, smallpox, diphtheria and scarlet fever. Statisticians, with pencil and paper, have been able to tabulate records which have proved beyond doubt the commercial, or dollar-and-cents, value of this work to the community.

It will be impossible to prove the full value of preventive dentistry and of the work of the Canadian Dental Hygiene Council in one generation, for while its efforts are concerned in correcting dental defects, arousing in the individual an interest in mouth health, creating a desire for better mouth hygiene through mechanical cleansing and the encouragement of periodical examinations—in all of which, I say, the value of the work is manifested—its real worth can only be recorded in the better health of future generations.

In order to measure the value of results achieved by the Canadian Dental Hygiene Council, it is necessary to consider these results under three classifications: (1) interest aroused; (2) action

*Read before the Section on Mouth Hygiene at the Midwinter Clinic of the Chicago Dental Society, Jan. 19, 1932.

*Full details of the programs and organization of the Canadian Dental Hygiene Council can be had by application to Dominion Headquarters, Medical Arts Building, Toronto, Canada.

stimulated, and (3) better health results achieved.

INTEREST AROUSED

It is apparent that an intense interest in better mouth health has been aroused in the minds of all—people in every walk of life. To prove this, it is only necessary to glance through almost any newspaper or magazine published today. There, we find not only paid-for articles on mouth health and the teeth, but also an advertising section crowded with advertisements stressing the fact that this or that will produce or maintain the health of the teeth and cleanliness of the mouth. Few meetings of medical societies or health clubs are held today without a discussion or an address on mouth health; in fact, the physician and the health expert appear to be just as definitely concerned as is the dentist, and sometimes it seems that the fathers and mothers of young children are more concerned than any of these. Therefore, it is obvious, from the point of view of interest aroused, that our mouth health programs have been of value.

ACTION STIMULATED

It is a little more difficult to prove the value of the campaign from the standpoint of action stimulated, but it is apparent to the practicing physician and dentist that the anxiety in the minds of the parents and growing boys and girls regarding oral and dental health, has stimulated them into definite action. They are studying and adopting a dietary which they are convinced will bring about better mouth health. They are visiting their dentist and physician more frequently for advice, and, beyond any doubt, more of them are exercising care in the mechanical cleansing of the mouth and teeth.

BETTER HEALTH RESULTS ACHIEVED

The health results achieved are most difficult of all to assess, for that word "health" is of such a varying standard. Recent examinations of thousands of high school boys and girls, in Canada, have made it necessary for us to revise figures on the incidence of dental decay and the number of neglected mouths. We have found that the average high school boy and girl of today has a better cared for and cleaner mouth than the boy or girl in a like class ten years ago. They also have fewer carious teeth, and the percentage showing an abscessed condition is decidedly lower. This is bound to result in better general health. It definitely assures better mastication, which, in turn, assures better digestive action and assimilation of the food. The modern boy and girl pay more personal attention to health than did the boy and girl of a decade ago. They must do this because of the present-day demands on their physical resources.

APPEAL TO VARIOUS GROUPS

The Canadian Dental Hygiene Council has found that, in order to carry its program to the public, it has to work through various groups, organizations and even governments. Therefore, in further measuring the value of the Council's effort, it is necessary to take stock of the reaction of these various groups to its program.

Parents.—As the first group, we shall consider the parents of growing children, for the newer theories on the building of sound teeth lead us back directly to the prenatal life of the child. In the program of the Canadian Dental Hygiene Council, we have taught this group the importance of the theory that, during the prenatal life of the child, the mother must have a knowledge of the bone-building or tooth-developing elements required, so that she may have sufficient of these, both for her own needs and for the needs of the developing child. We also teach that the various parts of the body are built, just as

definitely as a house is built, of the material provided for that purpose, different parts of the body requiring different elements, the teeth, for example, requiring mineral elements. It is essential, then, in order that the teeth may be well built, that there be furnished the body foods that contain mineral elements.

It has been demonstrated by Mrs. Mellanby, of London, England, in research work covering a long period of years, that when the teeth first come through the gums, a large number of them are imperfectly developed, possibly owing to a lack of the proper dietary elements.

The reaction of the parents to this instruction has been very gratifying. We have difficulty in satisfying all the demands for literature having a bearing on this subject, and requests for addresses to mothers' clubs and women's meetings are further evidence of the interest that has been aroused.

School Children.—The next group is the school children themselves. In order to reach these under the most favorable auspices, we have made a study of the best method of approach, and we are satisfied that the plan used in our program, of appealing to the school boy and girl through interest in athletics and the desire for improved appearance, accomplishment and achievement, rouses an enthusiastic response to our teachings. Telling the boy that, in order to be the best baseball player or a successful aviator, it is essential that he have good health, that good health is frequently dependent on a clean mouth and sound teeth and that these can be maintained through eating the right foods, proper mechanical cleansing and frequent examination by the dentist, has resulted in starting many an aspiring Babe Ruth or Lindbergh on the road to success.

Government Groups.—In Canada, it is desirable, as far as possible, that all health educational activities be carried on under the auspices of the departments of health, and also the departments of education. The Canadian Dental Hygiene Council, therefore, works through both of these, for dental health is definitely a general health matter, and, according to our present theories, it is also an educational matter. The work of the council is always conducted through the health departments of the governments of the various provinces, and thus we have the cooperation of the minister and deputy minister of health, the medical health officers in the various districts and the public health nurses. In working through the department of education, we obtain the active cooperation of the minister and deputy minister of education, which in turn assures us, under the very best auspices, the active assistance of the inspectors, principals and school teachers.

If the cooperation of these government departments is an indication of the value of our efforts, I am sure that results achieved here will rate high, for we have 100 per cent cooperation from all government officials. They are not only willing, but also eager to cooperate. In fact, many times in their enthusiasm to make our programs a success, we find it difficult to keep up with them. They frequently make our campaigns their campaigns, and take almost full responsibility for promoting them.

School Teachers.—This group is an extremely important one in any health effort, for, after all, health today is largely a matter of knowledge acted on. To best impart this knowledge, it is essential that we work through those who are most competent to teach, the school teachers, and in order that our lesson shall be continuously taught, we have had intro-

duced into the schools of five provinces of the Dominion, a textbook on oral hygiene or mouth health. This textbook has been sent out, in every case, by the minister of education of the particular province, and under his orders to the teachers, it is to be introduced into the regular course of instruction as of as much importance as any other subject.

Physicians, Nurses and Public Health Workers.—The interest manifested by many of this particular group indicates very plainly the value of our efforts. Their interest can be maintained only through the establishment of scientific proof of the need of our program, and of the benefits to be derived therefrom. We have succeeded in obtaining the full cooperation of this entire group. Physicians are keen, public health workers are keener and nurses are keenest in their interest, and the degree of interest of each section in this group is due to the opportunity afforded them for observation—observation of the disastrous effects of dental decay and of the benefits derived from the correction of that condition, and the maintenance of better mouth health.

Service Clubs and Church Men's Clubs.—The interest of this group gives us an opportunity to weigh the value of our program from the point of view of the hard-headed business man, and we can state definitely that we have been able to arouse their enthusiasm and, in many instances, we have inspired them to action. As a result of our programs, some service clubs have taken the responsibility of establishing free dental clinics for poor children in their city or community, and many more have given financial assistance in providing these.

The Dental Profession.—The program of the Canadian Dental Hygiene Council is of tremendous importance to the practicing dentist. The teaching of oral health and the practice of preventive dentistry leads him into an entirely new atmosphere. His point of view is changed. The patient in the chair is not his only concern, but his thoughts also go out to family and community welfare. He is thinking of preventive dentistry rather than purely corrective. He is compiling a complete family and health history of each patient. His advice to the patient not only has a bearing on the latter's welfare, but also governs the health of the patient's children and children's children. Thus is assured an ever-widening circle of health teaching, which will eventually embrace the whole community.

If these new principles of dentistry are to reach their full fruition, the individual dentist should have the assistance of voluntary dental health and public health organizations. There must be created outside his office a strong public opinion to support his new concepts, and this is the aim of the Canadian Dental Hygiene Council.

Back of every program of the Canadian Dental Hygiene Council, and constantly in our message, is one theme—the prevention of dental disease. The council is not so much concerned over the incidence of dental decay and abscessed teeth, other than as an indication of the greater need of prevention. The council is teaching that preventive dentistry means a proper diet, to build sound teeth at the time teeth are being built, and to maintain sound healthy teeth throughout life, a diet of foods that require mastication to ensure proper functioning of the teeth that they may establish a normal relation to one another. It also teaches proper mechanical cleansing or mouth hygiene to remove food particles that would cause acid formation, which brings about decalcification of the enamel; and, of course,

there must be periodical dental examinations, commencing at 2½ years of age.

SUMMARY

The value of the Mouth Health program of the Canadian Dental Hygiene Council lies in the fact that:

It is carrying on dental health educational work, not as a professional (dental) organization, but as a public health body specializing in this one branch of health work.

The Council's work is financed by grants from the federal government at Ottawa, the Canadian Life Insurance Officers' Association, the Canadian Oral Prophylactic Association, and other philanthropic and charitable sources.

By working through government departments, it leads the way to the permanent establishment of a division of dental health in connection with provincial health departments. It presents to them a definite program of mouth health, and assists them financially, and through organization, to promote it, always committing the province to an expenditure equal to the council's appropriation.

It carries on its dental health programs through organized groups such as public health and welfare bodies, thereby reaching the public under the best auspices.

It carries the message of better health and better mouth health to school children through regular educational channels, and inspires the pupil and the teacher with the thought that general health particularly, and dental health as a specialty, is a matter of education, improved habits of living, and frequent examination by the dentist; i.e., that it is a matter of prevention rather than of cure.

The programs of the Canadian Dental Hygiene Council have awakened in the minds of the general public a consciousness of the value of mouth health in relation to general health.

Finally, the programs are of value to the dental profession and the individual dentist through developing public opinion to support his efforts in preventive dentistry.

Buffalo—Harbor and Skyline

A STATE-WIDE DENTAL PROGRAM

By N. TALLEY BALLOU,* D.D.S., Richmond, Va.

A CONSIDERATION of public health must include all those agencies which go to make up a complete entity. No one phase can be neglected without impairing the completeness of the organization.

Virginia, early in her public health activities, recognized the need of dental representation on her advisory health board and, in 1916, the law was amended to include a dentist as a member of the board of health.

The several steps leading up to the establishment of the present mouth hygiene division of the bureau of child health may be briefly summarized as follows:

LEGISLATIVE ENACTMENT

The West Law, passed by the legislature in 1918, provided for the training of our public school teachers so that they might be prepared to make a physical inspection of school children at least once a year. This inspection which of necessity was very superficial, including only such tests as the teacher could make of the vision and hearing, taking the weight, noting any evidence of mouth breathing and the presence of adenoids and diseased tonsils, and the condition of the teeth, revealed startling physical defects.

COOPERATION OF THE DENTAL PROFESSION

As the percentage of dental defects was so large and the number of dentists located in the rural sections of the state so small, it was decided that the Virginia State Dental Association should be informed of the existing conditions and requested to make recommendations as to the best method of meeting the condition.

This was done and, as a result, a dentist was employed by the state board of health to make a survey of the state and to recommend to the board of health and the dental association such action as he deemed necessary. His recommendation was that since some form of corrective dental clinics were necessary, they should be carried on by the state board of health. As a result of this recommendation, a director of mouth hygiene was appointed, reporting for duty April 15, 1921.

THE VIRGINIA PLAN

It is unnecessary to go into the various plans tried out during the first few months, but the results of certain experiments have proved so satisfactory that practically no changes have been made in method since March 1, 1922, when the present plan was put into operation.

1. We started with the assumption that the best results could be obtained by cooperation between the state board of health, the county authorities and the children. It was definitely decided that the parents be required to contribute toward the cost of the clinic in proportion to the number of dental treatments found necessary. This contribution we fixed at fifty cents a treatment. Therefore, a child needing dental prophylactic care, one extraction and two fillings, four treatments in all, would be required to

*Director of Mouth Hygiene, Virginia State Department of Health.

contribute the sum of $2.00. This ruling was not intended to exclude those children whose parents were unable to contribute this small sum, all of the dental treatment necessary and which can be undertaken at the clinic being provided for such children. The aggregate contributions by the children have averaged approximately $110 less than the total cost of each clinic per month, this deficit being cared for by the state and county, each paying one-half. To more concretely state the arrangement: the cost to the state is approximately $55 a month, or $500 for each school term of nine months for each clinician employed.

2. After trying out various means of employment of dental clinicians, such as by the hour, day, week and month, it was decided to employ only full-time clinicians and for the school term. It was in keeping with the fixed policy of the state department of health to use full-time employes only.

3. Where there is a health officer in the county, the clinic is placed under his direction as an integral part of the county health work.

4. Treatment is limited to oral prophylaxis, amalgam, cement and, in selected cases, porcelain fillings and necessary extractions. No gold filling, crown and bridge work or treatment of pulpless teeth is undertaken. If root-canal treatment is thought to be indicated and there is reason to believe that the parent would have this done by the family dentist, we urge that such treatment be had immediately. On the other hand, if there is reason to believe that such treatment cannot or will not be secured by the parent, extraction is immediately resorted to to remove a potential source of focal infection in addition to removing a cause of possible continuous or periodic suffering on the part of the child.

5. In conformity with the opinion of the best authorities, the first or deciduous teeth are given the same care as the second or permanent set.

6. Clinics for white children and for colored children are held separately.

7. The children in the first seven grades only are treated. A careful examination of the mouths of high school pupils is made and a chart of the defects found is sent to the parents, urging that the necessary treatment be undertaken.

FIVE POINT PROGRAM

As a result of efforts to secure the correction of the physical defects found by the teachers, a movement known as the five point program was instituted. This provides that when a child is found by the teacher to have apparently normal vision, hearing, teeth and throat and is not more than 10 per cent under nor 20 per cent over weight, he or she receives a certificate signed by the state health commissioner and the state superintendent of public instruction and stamped with a seal of these two departments, stating that this child has met the minimum requirements of the five point program.

It is surprising how much interest is taken not only by the children but also by their parents in an effort to secure correction of the defects found by the teachers, in order that the children may meet the requirements. It must be distinctly understood that while the five point program is purely a teachers' project, an effort is made to have the throats examined by a physician and the teeth examined by a dentist.

Reports from dentists all over the state show that thousands of children are voluntarily visiting dentists and other thousands are transported by the teachers in school busses to have the necessary dental defects corrected. While in certain sections of the state where it is impossible

for an examination of the teeth to be made by a dentist, some of the children with dental defects are receiving the five point certificate, it is felt that this program has been the means of securing dental correction in an untold number.

It is believed that this has been one of the greatest movements ever started to promote health among school children. The movement is growing year by year, and it is hoped that, sometime in the future, all the children in the public schools of Virginia will receive an annual examination by a dentist.

A REMARKABLE DEMONSTRATION

One of the most remarkable health projects ever carried on by any country or state was instituted in Southampton County, Virginia, last year, under the direction of B. B. Bagby, county health officer. When a dental clinic was arranged for this county, Dr. Bagby stated that his hope was that he could have a 100 per cent correction of all dental defects of white children. This was a colossal undertaking owing to the fact that Southampton County had at that time only three dentists, who were all located in one town on the extreme eastern border. Another dentist is located in the county near the southern border. A careful examination of the mouths of children made with an explorer and a mirror showed that, of the total enrollment of 1,991, 1,666 children had a total of 4,682 dental defects. In an effort to interest the parents in the correction of these defects, a letter, signed jointly by the superintendent of schools and the county health officer, was sent to the home of every child in the schools, stressing the importance of the care of the teeth and asking cooperation in having the defects corrected. As a further inducement, a half-day holiday was promised to each classroom when all of the dental defects in that room had been corrected and an extra day holiday to each school when all of the defects in that school had been corrected.

The health officer, realizing the necessity of securing 100 per cent cooperation on the part of the teachers, promised an extra day holiday at Easter if the entire county went over the top. As a result of all of the publicity and work on the part of the health and school authorities, two days before Easter the health officer had in hand either from the school clinicians or the private practitioners certificates that they had either corrected all dental defects or had collected the necessary sum of money to pay the cost of all defects to be corrected.

There was one little hitch on the last day in one school where one boy who had recently moved into the county needed to have two deciduous teeth extracted. He did not seem willing to part with these two offending members, and although the county superintendent, health officer, nurse, the dentist, and even the preacher, visited the mother, she did not agree to have the teeth removed until the spirit moved the youngster. On hearing his decision, some of the boy's classmates invited him out to the woodshed and offered to assist in the removal of these two teeth. Thinking that possibly the dentist could remove them better than his classmates, he agreed to go to the clinician and have the teeth extracted, thus making the white children of the county 100 per cent dentally sound. All of the treatments paid for before Easter were actually performed before the end of the school term, thus making the white school children of Southampton County, Virginia, as far as is known, the first and only county in Virginia, or any other state, to be 100 per cent dentally fit.

CLINICS AND PRIVATE PRACTITIONERS

As to the economic value of this demonstration from a purely dental viewpoint: Of the 1,666 children needing dental treatment, 904 were actually treated by the school dental clinician and 762 were treated by the dentists in Southampton and adjoining counties. One of the county dentists who charges average fees estimated that if all of the children treated by the private practitioners had the same number of defects as those treated by himself, and if the other dentists charged the same fees, the clinic was the means of sending to the private practitioners more than $5,000 in additional work during the six months which the clinic lasted.

I have on numbers of occasions been approached by private practitioners in counties where clinics have been formerly held with the inquiry as to when the next clinic will be conducted. These practitioners always state that the dental clinic is a great stimulus to their practice, not only in sending school children to their office, but also as a means of educating the parents to the necessity for dental treatment.

The following is a summary of the activities of the Mouth Hygiene Division of the Bureau of Child Health, Virginia State Department of Health, for the past nine years:

Number of counties in which clinics were held	78
Number of clinics held (each school term during which clinician worked being counted as a separate clinic)	236
Number of children examined	225,092
Number of children treated	112,446
Total number of operations	350,148
Total cost of clinics	$226,482.49
Total contributed by children	131,353.53
Net cost of clinics	95,128.96
Number of full-time clinicians employed	46
Number of part-time clinicians employed	40
Total number of clinicians	86

While the contribution of fifty cents per operation is small, the aggregate contributions by the school children take care of approximately two-thirds of the entire cost of the clinic. If it were not for these contributions, only one-half of the counties now receiving this service could be taken care of. It might be added that the largest dental dispensaries in the country with unlimited endowment make it a rule that every child treated must contribute a small sum for such treatment.

THE CINCINNATI MOUTH HYGIENE CAMPAIGN*

SPECIAL ACTIVITIES

(C. J. Hudson, Chairman)

Boy Scouts.—Early in the campaign, letters were addressed to young people's organizations, children's homes and similar groups, asking them to stress mouth hygiene in their health programs for the year. A letter from the director of one of the boys' homes expressed interest and asked for further suggestions as to plans. A letter from the director of the Boy Scouts also expressed interest and requested assistance. An outline was drafted giving this information. Dr. Hudson was appointed chairman of a subcommittee to promote the program among the Boy Scouts. The director was inter-

*This article is continued from the July issue of THE JOURNAL. In the next issue, a presentation of some of the form letters, pictures of window displays and other information in connection with the campaign will be made.

viewed and two special features were decided on: 1. A slogan contest, a banner to go to the troop submitting the best slogan on the importance of healthy mouths. 2. A better teeth contest. In this contest, cards were issued to members of the troops entering the contest, which will be taken to a dentist or a dental clinic. Return of the cards will indicate that all dental corrections have been made. The troop having the highest percentage of dental corrections will be awarded a cup.

Letters were sent to all troop leaders requesting their cooperation and submitting rules for both contests. Owing to various special activities of the Boy Scouts, the plan was not inaugurated until the intensive campaign week, to extend until September, 1932. This will give Scouts an opportunity to have dental corrections made during the summer.

Girl Scouts.—The secretary of the committee interviewed the director of Girl Scouts regarding their participation in the program. A special issue of the *Compass* was devoted to health, emphasizing dental care, and troops were urged to enter a better teeth contest. Cards were issued similar to those used in the Boy Scout contest and the campaign was opened during Girls' Week immediately following Mouth Hygiene Week and will close in September.

Industries.—In distributing window cards to industries, a request came for enough cards to place on bulletin boards where employes might see them. This suggested that plant bulletin boards would be an excellent medium for an educational message. R. G. DeVoist, of the Anti-Tuberculosis League, submitted a list of 300 industries employing twenty-five men or more. A poster was prepared and mailed with a letter to these industries explaining the purpose of Mouth Hygiene Week and requesting that the poster be displayed.

National Dairy Council (Ohio Valley Unit).—While the contributions of the National Dairy Council have been mentioned in connection with other committees, it is believed that special mention should be made of this organization. In addition to the screens and posters, mechanical devices and signs for window displays, the National Dairy Council made other valuable contributions, perhaps the most outstanding one being the printing of 100,000 bottle collars which were supplied to milk dealers and distributed on milk delivered to homes during Mouth Hygiene Week. Four hundred posters were supplied by the National Dairy Council for distribution among high schools. Two hundred bore a picture of an attractive boy and girl and 200 were the small Goldsmith poster—"Your teeth are as precious as your class pin—drink milk for lunch."

Miss Ada Lockhart of the Ohio Valley Unit gave suggestions for school programs and other projects. Miss Lockhart stressed the care of teeth in her regular health talks before schools and mothers' clubs and all during the campaign.

S. T. Pyper, director of the Ohio Valley Unit, attended committee meetings, giving advice and showing a splendid spirit of cooperation. A wagon poster was prepared and several milk dealers had offered to display it on their milk wagons, but owing to some misunderstanding, the poster was not printed in time.

The National Dairy Council also included mention of the Mouth Hygiene Campaign in their advertisement on the Home Beautiful Exposition, March 9.

COUNTY

(E. H. Schoenling, Chairman)

Not many special activities were car-

ried on in the county in connection with the Mouth Hygiene Campaign. The county dental service, under the direction of the Hamilton County Health District, carried on its regular program, which includes examinations by a dental hygienist and care by the dentist for children unable to pay.

On January 1, a public health nurse was appointed director of health education for the county health department, and she prepared and sent to schools suggestions for emphasizing mouth hygiene in the regular classroom work.

Through the corps of sanitary inspectors and other workers in the health department, window cards were distributed to druggists and grocers, who were urged to arrange exhibits.

CONCLUSION

It is always difficult, if not impossible, to judge the results of an educational campaign. The committee believes that had this campaign been conducted during prosperous years, the results would have been evident in increased attendance at dental clinics and an increase in first visits to dentists' offices. Owing to the unemployment situation, many persons who might have been attracted by the campaign and interested in seeking dental care are prevented by lack of funds. One thing was shown very definitely and that was that, because of the close relationship between agencies in Cincinnati, cooperation in well-organized educational campaigns is easy to secure. This was not a new discovery, but has been shown repeatedly. When a project was well thought out and presented in a definite form, it met with courteous consideration. This does not mean that it was always carried out, although the majority of suggestions were.

The fact that the committee wrote forty-five letters thanking organizations and individuals for participation in the campaign gives some idea of the extent of the cooperation with which the committee met. This is exclusive of the members of the dental society or the staff of any of the organizations sponsoring the campaign.

Lafayette Square in the heart of Buffalo

AMERICAN DENTAL ASSOCIATION SEVENTY-FOURTH ANNUAL SESSION

BUFFALO, NEW YORK, SEPT. 12, 13, 14, 15, 16, 1932

OFFICIAL CALL

To the Members of the American Dental Association:

You are hereby notified that the Seventy-Fourth Annual Session of the American Dental Association will be held at Buffalo, N. Y., Sept. 12-16, 1932.

The House of Delegates will convene at 10:00 a.m., Monday, September 12; the second meeting will be held on Monday at 2:30 p.m.; the third meeting on Wednesday, September 14, at 2:30 p.m., and the fourth meeting on Thursday, September 15, at 2:30 p.m. The four meetings of the House of Delegates will be held in the Ballroom of the Hotel Statler. The Credentials Committee will register Delegates and Alternates, beginning at 10 a.m., Sunday, September 11, at the Hotel Statler.

All other members will register at the Registration Office in the 174th Armory. The Registration Department will be open from 9:00 a.m. to 5:00 p.m., Sunday, September 11, and from 8:30 a.m. to 5:00 p.m., Monday, Tuesday, Wednesday, Thursday and Friday, September 12, 13, 14, 15 and 16.

The general meeting which constitutes the opening exercises of the Session will be held Tuesday, September 13, at 9:30 a.m. The second and third general meetings will be held on Tuesday and Wednesday, September 13 and 14, at 7:45 p.m. The three general meetings will be held in the Ballroom of the Hotel Statler.

The constituent societies are hereby notified to file with the Secretary of this Association, at least thirty (30) days prior to the first day of said Annual Session, a list of the names and addresses of their Delegates and Alternates.

MARTIN DEWEY, *President.*
HARRY B. PINNEY, *Secretary.*

GENERAL PROGRAM

Registration (General) ..... Sunday, September 11, 9:00 a. m.
(174th Armory)

Registration (Delegates and Alternates) ..... Sunday, September 11, 10:00 a. m.
(Hotel Statler)

Board of Trustees (First Meeting) ..... Saturday, September 10, 10:00 a. m.
(Hotel Statler)

Board of Trustees (Second Meeting) ..... Saturday, September 10, 2:00 p. m.
(Hotel Statler)

House of Delegates (First Meeting) ..... Monday, September 12, 10:00 a. m.
(Ballroom, Hotel Statler)

House of Delegates (Second Meeting) ..... Monday, September 12, 2:30 p. m.
(Ballroom, Hotel Statler)

House of Delegates (Third Meeting) ..... Wednesday, September 14, 2:30 p. m.
(Ballroom, Hotel Statler)

House of Delegates (Fourth Meeting) ..... Thursday, September 15, 2:30 p. m.
(Ballroom, Hotel Statler)

PRELIMINARY PROGRAM FOR BUFFALO SESSION

FIRST GENERAL MEETING

(Ballroom, Hotel Statler)

TUESDAY, SEPT. 13, 1932

9:30 a.m. Music
DeWitt C. Garretson (orchestra) ..... Buffalo, N. Y.

10:00 Invocation
Right Rev. Cameron J. Davis ..... Buffalo, N. Y.

10:05 Music (Solo)
Geraldine Ayres ..... Buffalo, N. Y.

10:15 Greetings from the City of Buffalo
Mayor Charles E. Roesch ..... Buffalo, N. Y.

10:30 Address of Welcome from the Dental Society of the State of New York
Fred B. Howe, President ..... Ithaca, N. Y.

10:45 Response of the American Dental Association
John J. Ogden ..... Memphis, Tenn.

11:00 Music (Solo)
Geraldine Ayres ..... Buffalo, N. Y.

11:10 "The Disadvantage of Health Insurance and State Dentistry as Related to the Public and Profession"
By John Oppie McCall ..... New York City

11:40 Music
DeWitt C. Garretson ..... Buffalo, N. Y.

SECOND GENERAL MEETING

(Ballroom, Hotel Statler)

TUESDAY, SEPT. 13, 1932

7:45 p.m. Music
DeWitt C. Garretson.....Buffalo, N. Y.

8:00 Music (Solo)
Robert Butler.....Buffalo, N. Y.

8:10 "Nutrition as Related to Dental Practice"
By Sherman L. Davis.....Washington, D. C.

8:40 Music (Solo)
Robert Butler.....Buffalo, N. Y.

8:50 Music
DeWitt C. Garretson.....Buffalo, N. Y.

THIRD GENERAL MEETING

(Ballroom, Hotel Statler)

WEDNESDAY, SEPT. 14, 1932

7:45 p.m. Music
DeWitt C. Garretson.....Buffalo, N. Y.

8:00 Music (Solo)
Geraldine Ayres.....Buffalo, N. Y.

8:10 "A Study of the Development of the Human Jaws and Surrounding Structures from Birth to the Age of Fifteen Years"
By William H. G. Logan and Rudolf Kronfeld.....Chicago, Ill.

8:40 Music (Solo)
Geraldine Ayres.....Buffalo, N. Y.

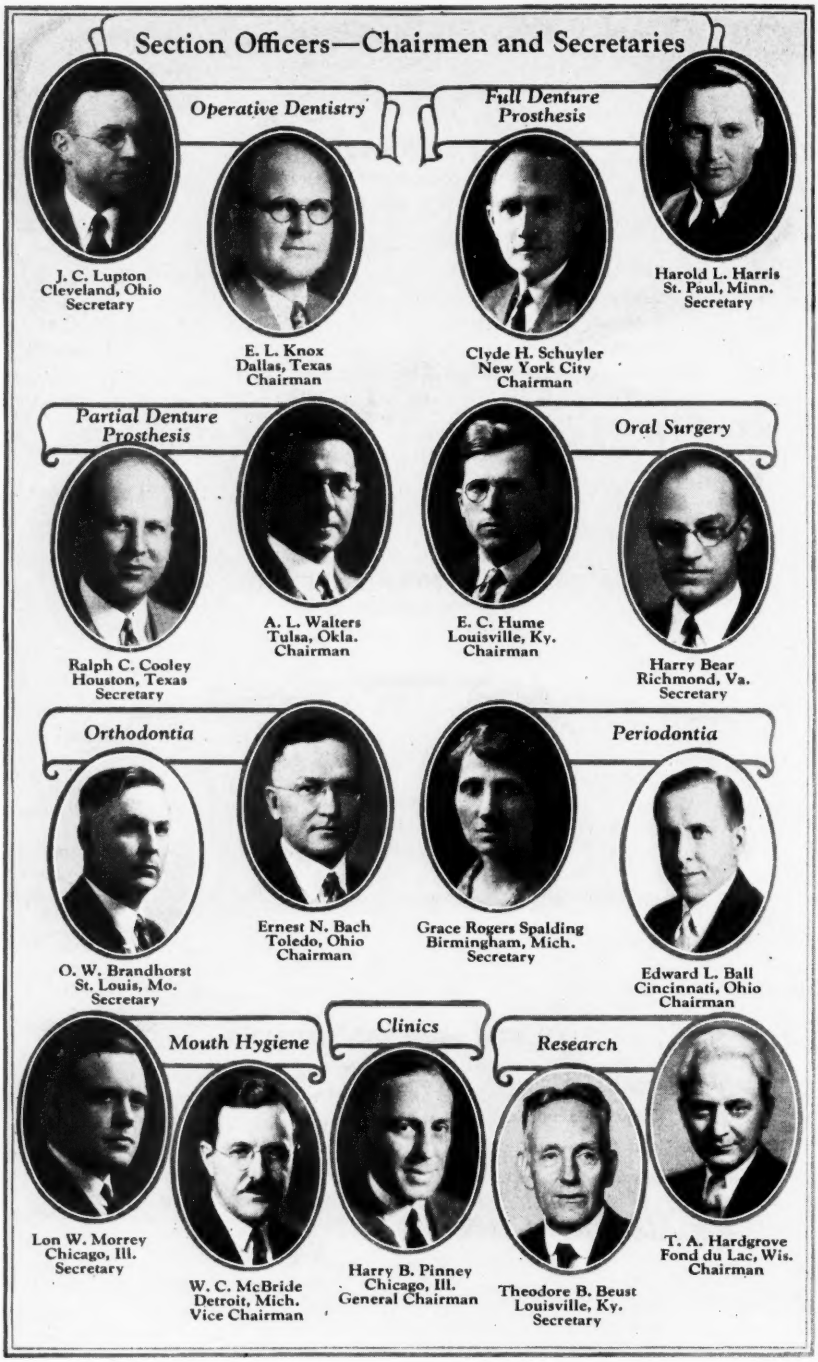
8:50 Music
DeWitt C. Garretson.....Buffalo, N. Y.

FOURTH GENERAL MEETING

(Ballroom, Hotel Statler)

THURSDAY, SEPT. 15, 1932

9:30 p.m. to 1:00 a.m. Grand Ball (Formal)
In honor of retiring President, Martin Dewey



CHAIRMEN AND SECRETARIES OF THE SCIENTIFIC SECTIONS OF THE AMERICAN DENTAL ASSOCIATION, 1932

THE SCIENTIFIC SECTIONS

TUESDAY, SEPTEMBER 13

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Room G, Third Floor, 174th Armory. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

E. L. Knox, Chairman.....Dallas, Texas
R. W. Edwards, Vice Chairman.....
.....Kansas City, Mo.
J. C. Lupton, Secretary.....Cleveland, Ohio

2 to 5 p. m.

"Twentieth Century Follies of Operative Dentistry"
By Paul A. Edmand.....Chicago, Ill.

Discussed by
F. H. Hall.....Nashville, Tenn.
Willard F. Andes.....Miami, Fla.

"Slice and Slice Lock Cavity Preparations for Inlays"
By Karl W. Knapp.....New York City

"Application of Recent Developments in Inlay Casting"
By H. D. Coy.....Hamburg, Iowa

Discussed by
Norman H. Denner.....Cleveland, Ohio
A. F. Schopper.....Kansas City, Mo.

FULL DENTURE PROSTHESIS

(Room H, Third Floor, 174th Armory, All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Clyde H. Schuyler, Chairman.New York City
Bert L. Hooper, Vice Chairman.....
.....Lincoln, Nebr.
Harold L. Harris, Secretary...St. Paul, Minn.

2 to 5 p. m.

"Treatment of Malocclusion and Loss of Retention in Full Denture Prosthesis"
By R. O. Schlosser.....Chicago, Ill.

Discussed by
Felix A. French.....Ottawa, Canada

"Anatomy and Diagnosis"
By Merrill G. Swenson...Richmond, Va.

Discussed by
P. C. Lowery.....Detroit, Mich.

"Further Studies of the Minute Anatomy of the Maxilla and the Mandible in Relation to the Problem of Full Denture Retention"
By E. C. Pendleton.....Chicago, Ill.

Discussed by
E. S. Smith.....Iowa City, Iowa

"Answer to MacMillan"
By Russell W. Tench.....New York City

Discussed by
A. J. Bush.....Columbus, Ohio

PARTIAL DENTURE PROSTHESIS

(Room B, Second Floor, 174th Armory. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

A. L. Walters, Chairman.....Tulsa, Okla.
Herbert E. King, Vice Chairman.....
.....Omaha, Nebr.
Ralph C. Cooley, Secretary..Houston, Texas

2 to 5 p. m.

"Some Nutritional Phases of Dental Conditions"
By Percy R. Howe.....Boston, Mass.

Discussed by
George Wood Clapp.....New York City

"Pedodontic Opportunities and Responsibilities"
By Floyd E. Gibbon.....Buffalo, N. Y.

Discussed by
James J. Ailinger.....Buffalo, N. Y.

"Balanced Occlusion"
By Rupert E. Hall.....Chicago, Ill.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Room A, Second Floor, 174th Armory. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

E. C. Hume, Chairman.....Louisville, Ky.
Frank W. Rounds, Vice Chairman.....
.....Boston, Mass.
Harry Bear, Secretary.....Richmond, Va.

2 to 5 p. m.

"Preanesthetic Medication"
By C. H. Burmeister.....Cincinnati, Ohio

Discussed by
E. L. Moravec.....Cedar Rapids, Iowa
Arthur E. Smith.....Los Angeles, Calif.

"Osteomyelitis of the Bones of the Face; Diagnosis and Treatment"
By Earle H. Thomas.....Chicago, Ill.

Discussed by
Theodor Blum.....New York City
Roy S. Hopkinson.....Milwaukee, Wis.

"An Analysis of Anesthetic Problems in Exodontia"
By Frank W. Rounds.....Boston, Mass.

Discussed by
D. P. Snyder.....Columbus, Ohio
Martin L. DeBats.....Detroit, Mich.

ORTHODONTIA

(Room C, Second Floor, 174th Armory. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Ernest N. Bach, Chairman.....Toledo, Ohio
Henry F. Hoffman, Vice Chairman.....
.....Denver, Colo.
O. W. Brandhorst, Secretary...St. Louis, Mo.

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2 to 5 p. m.

"Technical Procedure in Diagnosis and Treatment of Malocclusion"
By George W. Grieve..Toronto, Canada

"Biologic Concept of Orthodontia"
By Homer B. Robison..Hutchinson, Kan.

"Proper Time for Starting Orthodontic Treatment"
By Samuel J. Lewis.....Detroit, Mich.

Discussed by
Richard Lowy.....Newark, N. J.

"Uses and Abuses of Orthodontic Appliances"
By Frank M. Casto.....Cleveland, Ohio

PERIODONTIA

(Room E, Second Floor, 174th Armory. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Edward L. Ball, Chairman..Cincinnati, Ohio
M. Monte Bettman, Vice Chairman.....
.....Portland, Ore.
Grace Rogers Spalding, Secretary.....
.....Birmingham, Mich.

2 to 5 p. m.

"Oral Diagnosis"
By F. W. Merrifield.....Evanston, Ill.

Discussed by
C. J. Caraballo.....Tampa, Fla.

"Pathology of Periodontal Tissues"
By William M. Reppeto....Dallas, Texas

Discussed by
Rudolf Kronfeld.....Chicago, Ill.

"Acute and Chronic Vincent's Infection"
By S. Leonard Rosenthal.....
.....Philadelphia, Pa.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Room F, Third Floor, 174th Armory. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

E. H. Early, Chairman.....Darlington, S. C.
W. C. McBride, Vice Chairman.....
.....Detroit, Mich.
Lon W. Morrey, Secretary.....Chicago, Ill.

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2 to 5 p. m.

"A Practical Dietary for Children"
By W. A. Cotton.....New York City

"Some Everyday Problems in Children's Dentistry"
By George E. Morgan..Milwaukee, Wis.

"Restorations of Greater Permanency During Childhood"
By Corvin F. Stine.....Evanston, Ill.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Room D, Second Floor, 174th Armory. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

T. A. Hardgrove, Chairman.....
.....Fond du Lac, Wis.
E. D. Coolidge, Vice Chairman..Chicago, Ill.
Theodore B. Beust, Secretary..Louisville, Ky.

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2 to 5 p. m.

"Quantitative Estimation of Mouth Organisms by Direct and Plate Count"
By H. T. Knighton.....Rochester, N. Y.

"Actinomycosis of the Head and Neck"
By Fred Z. Havens (M.D.).....
.....Rochester, Minn.

"Histopathology of Chronic Periapical Inflammation"
By Rudolf Kronfeld.....Chicago, Ill.

"Nutritional Studies in Relation to Mouth Health"
By R. Gordon Agnew..Toronto, Canada

"Tissue Tolerance to Foreign Materials"
By U. G. Rickert.....Ann Arbor, Mich.

WEDNESDAY, SEPTEMBER 14

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Room G, Third Floor)

9 a. m. to 12 m.

"Plastic Surgery; Its Relation to Dental Problems"
By Albert D. Davis.San Francisco, Calif.

"Some Observations Relating to the Comfort and Care of the Teeth During Mechano-surgical Procedures"
By Ralph C. Cooley.....Houston, Texas

"Properties and Use of Plasters; Simple Impression and Duplicating Technic"
By J. V. Gentilly.....Cleveland, Ohio

FULL DENTURE PROSTHESIS

(Room H, Third Floor)

9 a. m. to 12 m.

"The Denture Space"
By E. J. Farmer.....Buffalo, N. Y.

Discussed by
I. Lester Furnas.....Cleveland, Ohio
Harold L. Harris.....St. Paul, Minn.

"Surgical Preparation of Mouths for the Reception of Artificial Dentures"
By George C. Pike.....Chicago, Ill.

Discussed by
Leo Winter.....New York City

"Incisal Guidance"
By Luzerne G. Jordan..Cleveland, Ohio

PARTIAL DENTURE PROSTHESIS

(Room B, Second Floor)

9 a. m. to 12 m.

"Some Common Causes of Failure in Partial Denture Service"
By George W. Wilson..Milwaukee, Wis.

Discussed by
W. I. McNeil.....Chicago, Ill.

"Restoring Functional Balance on the Masticatory Surface of Teeth That Have Migrated from the Normal Relationship"
By B. F. Sapienza.....Birmingham, Ala.

Discussed by
Joseph L. Cleveland.....Buffalo, N. Y.

"Essential Factors in Fixed Bridge Restorations"
By Stanley D. Tylman.....Chicago, Ill.

Discussed by
DeForest Davis .....Cleveland, Ohio

"Spring Lock Method of Functionating Dental Restoration; the Distal Extension Bridge Designed on This Principle"
By F. G. Neurohr.....New York City

Discussed by
Carl W. Hoffer.....Nashville, Tenn.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Room A, Second Floor)

9 a. m. to 12 m.

"Removal of the Impacted Cuspid"
By Wilton W. Cogswell.....
.....Colorado Springs, Colo.

Discussed by
L. M. Fitzgerald.....Dubuque, Iowa
Horace M. Davis .....Baltimore, Md.

"Roentgen Ray Interpretation as a Guide in General Exodontia"
By Fred F. Molt.....Chicago, Ill.

Discussed by
Menifee R. Howard.....Denver, Colo.
Harry Bear .....Richmond, Va.

"Exodontist's and General Practitioner's Obligation in Handling the Referred Patient"
By E. W. Browning.Salt Lake City, Utah

Discussed by
Dayton Dunbar Campbell.....
.....Kansas City, Mo.
Bissell B. Palmer, Jr.....New York City

ORTHODONTIA

(Room C, Second Floor)

9 a. m. to 12 m.

"Advantages and Disadvantages of Stock Appliances as Compared with Those Especially Constructed for the Case"
By Walter H. Ellis.....Buffalo, N. Y.

"Under What Conditions Should a General Practitioner Include Orthodontia in His Practice?"
By Harold M. Clapp.....Utica, N. Y.

"Conditions Making Orthodontia Unsatisfactory in Combination with General Practice"
By M. L. Fay.....Buffalo, N. Y.

Discussed by
Walter H. Ellis.....Buffalo, N. Y.

PERIODONTIA

(Room E, Second Floor)

9 a. m. to 12 m.

SYMPOSIUM

"Visualizing the Mouth as a Masticatory Unit"
By Carl W. Hoffer.....Nashville, Tenn.

"One Piece Cast Restoration"
By Carlos H. Schott.....Cincinnati, Ohio

"Bridge Selection by the Periodontist"
By E. B. Spalding....Birmingham, Mich.

Correlated by
T. W. Maves.....Cleveland, Ohio

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Room F, Third Floor)

9 a. m. to 12 m.

SYMPOSIUM ON THE CARE OF CHILDREN'S TEETH

(Pedodontic Section, Detroit Clinic Club)

"Management"
C. W. Wilson.....Detroit, Mich.

"Operative Procedure"
Earle G. Keim.....Dearborn, Mich.

"Anesthesia and Extractions"
Fred Wertheimer .....Detroit, Mich.

"Business Phase of Pedodontia"
W. C. McBride.....Detroit, Mich.

"The Progress of Dental Decay"
Charles F. Bödecker.....New York City

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Room D, Second Floor)

9 a. m. to 12 m.

"Some Effects of Dietary Conditions on Crystal Formation in the Enamel of Rat Incisors"
By P. C. Kitchin.....Columbus, Ohio
R. D. McFarland.....Columbus, Ohio

"How Can the Dental Profession of the World Make Cancer of the Mouth a Preventable Disease?"
By Joseph C. Bloodgood (M.D.).....
.....Baltimore, Md.

"Practical Aspect of Filling Root Canals"
By John P. Buckley....Hollywood, Calif.

"Oral Conditions in Agranulocytosis"
By Thomas J. Cook....Philadelphia, Pa.

"Hardness of Teeth as Shown Microscopically"
By H. C. Hodge.....Rochester, N. Y.

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Room G, Third Floor)

2 to 5 p. m.

SYMPOSIUM ON SPHERICAL PRINCIPLES OF OCCLUSION

"Elements of Diagnosis"
By Harry G. Morton...Milwaukee, Wis.

"Mechanics of the Open-Bite Technic"
By E. R. Hart.....St. Louis, Mo.

"The Periodontal Lesion in Its Relation to Occlusal Trauma"
By E. D. Rose.....Bowling Green, Ky.

FULL DENTURE PROSTHESIS

(Room H, Third Floor)

2 to 5 p. m.

"Practical Denture Construction Based on a Study of the Operation of Dentures During Functional Activity"
By Carl O. Flagstad..Minneapolis, Minn.

"Aids to Esthetics in Denture Construction"
By Irving R. Hardy.....New York City

Discussed by
Bert L. Hooper.....Lincoln, Nebr.

PARTIAL DENTURE PROSTHESIS

(Room B, Second Floor)

2 to 5 p. m.

"Wrought Gold Alloys: Physical Properties and a Specification"
"Cristobalite for Dental Investments"
"Progress Report for Year 1931-1932"
By William Souder...Washington, D. C.
George C. Paffenbarger.....
.....Chevy Chase, Md.
William T. Sweeney.....
.....Washington, D. C.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Room A, Second Floor)

2 to 5 p. m.

"Diagnosis and Treatment of Acute Cellulitis"
By Sterling V. Mead..Washington, D. C.

Discussed by
Charles M. Proctor.....Boston, Mass.
George W. Christiansen..Detroit, Mich.

"Systemic Effects of Oral Foci of Infection"
By Nelson G. Russell.....Buffalo, N. Y.

Discussed by
Harry M. McFarland..Kansas City, Mo.
Walter F. Barry.....Newark, N. J.

"Malignant and Other Growths About the Mouth"
By Chalmers J. Lyons..Ann Arbor, Mich.

Discussed by
A. L. Frew.....Dallas, Texas
T. A. Hardgrove.....Fond du Lac, Wis.

ORTHODONTIA

(Room C, Second Floor)

2 to 5 p. m.

"A Review of Postgraduate Education in Orthodontia"
By Earl G. Jones.....Columbus, Ohio

Discussed by
C. Angus Kennedy.....Toronto, Ontario

"Children's Dentistry in Relation to Orthodontia"
By F. B. Rhobotham.....Chicago, Ill.

"Considerations in the Design and Manipulation of Orthodontic Appliances with Particular Reference to Rigidity"
By Edward M. Griffin...New York City

Discussed by
L. B. Higley.....Iowa City, Iowa

"Orthodontic Correction of Extreme Distoclusion: Report of Case"
By G. Vernon Fisk.....Toronto, Ontario

PERIODONTIA

(Room E, Second Floor)

2 to 5 p. m.

SYMPOSIUM

"Technic of Surgical Treatment of Periodontoclasia"
By Frank Kaiser.....Los Angeles, Calif.

"Conservative Treatment of Periodontal Diseases"
By Austin F. James.....Chicago, Ill.

"Surgical Treatment of Periodontoclasia"
By Robert L. Dement.....Atlanta, Ga.

Correlated by
Justin D. Towner.....Memphis, Tenn.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Room F, Third Floor)

2 to 5 p. m.

"The Children's (Couzens) Fund of Michigan"
By K. R. Gibson.....Detroit, Mich.

"Shall We Extract the Nonvital Deciduous Tooth?"
By Charles A. Sweet.....Oakland, Calif.

"Value of Ethyl Chlorid for Extraction of Deciduous Teeth"
M. H. Jacobs.....Boston, Mass.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Room D, Second Floor)

2 to 5 p. m.

"Research on Dental Caries Over a Period of Nine Years"
By J. J. Enright.....Pittsburgh, Pa.
H. E. Friesell.....Pittsburgh, Pa.

"Studies of Salivary Mucin"
By E. C. Dobbs.....Rochester, N. Y.

"Reactions of the Dentin Under Decay"
By Theodore B. Beust....Louisville, Ky.

"Effect of Various Reagents on Mucin Smears"
By Edward H. Hatton.....Chicago, Ill.

"Is Traumatic Occlusion per Se Responsible for Hypercementosis?"
By James L. Zemsky.....New York City

THURSDAY, SEPTEMBER 15

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Room G, Third Floor)

9 a. m. to 12 m.

"Study Club Work on Gold Foil"
By James Mark Prime....Omaha, Nebr.

"Clinical Observations on Erosion and the Restoration of These Areas"
By W. I. Ferrier.....Seattle, Wash.

Discussed by
John S. Dohan.....Montreal, Canada
James A. Loughry.....Cleveland, Ohio

"Fixed Bridgework of the Future"
By F. S. Meyer.....Minneapolis, Minn.

THURSDAY, SEPTEMBER 15

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Room G, Third Floor)

9 a. m. to 12 m.

SYMPOSIUM ON PORCELAIN

"Color Selection and Reproduction"
By E. Bruce Clarke.....Uniontown, Pa.

"Manipulation and Firing of Porcelain"
By T. H. Forde.....San Francisco, Calif.

"Future of Operative Dentistry"
By Arthur D. Black.....Chicago, Ill.

"Orthodontia Applicable to Reconstruction Work"
By Leigh C. Fairbanks.....
.....Fort Leavenworth, Kan.

Discussed by
Harry Allshouse, Jr.....Kansas City, Mo.
Leo M. Shanley.....St. Louis, Mo.

"Precision Castings Utilizing the Hydroscopic Action of Plaster in Investments in Making Expanded Molds"
C. H. Scheu.....Cleveland, Ohio

FULL DENTURE PROSTHESIS

(Room H, Third Floor)

9 a. m. to 12 m.

"Impression Technic"
By S. Harold Supplee....New York City

"Prolonging Efficient Service of Prosthetic Dentures"
By Walter H. Wright....Pittsburgh, Pa.

PARTIAL DENTURE PROSTHESIS

(Room B, Second Floor)

9 a. m. to 12 m.

"The Mechanics of Equilibrium During Functional Movements of the Mandible"
By Hugh W. MacMillan..Cincinnati, O.

Discussed by
F. C. Elliotte.....Memphis, Tenn.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Room A, Second Floor)

9 a. m. to 12 m.

"Oral Infection and Its Relation to Maxillary Sinusitis"
By John F. Fairbairn.....Buffalo, N. Y.

Discussed by
R. Boyd Bogle.....Nashville, Tenn.
Allen S. Wolfe.....Washington, D. C.

"Removal of Impacted Mandibular Third Molars"
By Boyd S. Gardner....Rochester, Minn.

Discussed by
Joseph P. Wahl.....New Orleans, La.
Arthur C. Engel.....St. Louis, Mo.

"Cysts of the Jaws"
By Henry S. Dunning....New York City

Discussed by
Aubrey L. Martin.....Seattle, Wash.
J. A. Blue.....Birmingham, Ala.

ORTHODONTIA

(Room C, Second Floor)

9 a. m. to 12 m.

"Preventive Orthodontia and Its Practical Application in General Practice"
By C. S. Foster.....Cedar Rapids, Iowa

"Correction of Mesioclusion Caused by Pernicious Tongue Habit and Enlarged Tonsils: Report of Case"
By E. W. Patton.....Birmingham, Ala.

Case Report
By George R. Moore...Ann Arbor, Mich.

PERIODONTIA

(Room E, Second Floor)

9 a. m. to 12 m.

"Roentgenographic Study of the Alveolar Septum"
By A. B. Crane.....Washington, D. C.
Harry Kaplan....Washington, D. C.

Discussed by
Hugh W. MacMillan....Cincinnati, Ohio

"Periodontia: Its Relation to the Economics of a Community in Its Social Activities"
By H. E. Germann.....Cincinnati, Ohio

"Importance of Casts in Periodontia Practice"
By Isador Hirschfeld....New York City

"Oral Prophylaxis in Its Relation to Prevention and Treatment of Periodontal Diseases"
By Arthur H. Merritt....New York City

Discussed by
J. A. Jacobsmeyer.....St. Louis, Mo.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Room F, Third Floor)

9 a. m. to 12 m.

"Hospital Internship for Dentists"
S. W. A. Franken.....New York City

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Room D, Second Floor)

9 a. m. to 12 m.

"A Study of the Incidence of Dental Decay in Large Rat Populations"
By Henry Klein.....Baltimore, Md.
J. Ernestine Becker..Baltimore, Md.

"Histopathology of Systemic Lesions That as a Result of Focal Infection"
By John M. Gulas.....Milwaukee, Wis.

"Histology and Bacteriology of the Enamel Surface"
By Basil G. Bibby.....Rochester, N. Y.
G. Vanhuysen.....Rochester, N. Y.

"Investigations Indicating that Saliva Solubility for Phosphorus Largely Establishes Levels for Immunity and Susceptibility to Dental Caries"
By Weston A. Price....Cleveland, Ohio

"Distribution of Mottled Enamel in the United States"
By C. T. Messner.....Washington, D. C.

GENERAL CLINIC PROGRAM

THURSDAY AFTERNOON, SEPTEMBER 15— FRIDAY AFTERNOON, SEPTEMBER 16

GROUP 1: COLLEGE CLINICS

Tufts College Dental School Clinic

"Practical Porcelain: A Standardized Procedure for the Clinical and Technical Preparation of Porcelain Jacket and Thimble Crowns"
Arthur T. Palmer.....Lynn, Mass.
L. Walter Brown, Jr.....Boston, Mass.

University of Illinois

"Root Canal Treatment for Deciduous Teeth"
Elsie Gerlach .....Chicago, Ill.

"Oral Diagnosis of Hemophilia, Vincent's Infection, Etc., with Roentgen-Ray Interpretation"
Paul Lilja Lane.....Chicago, Ill.

"Root Canal Medication"
E. C. Wach.....Chicago, Ill.

GROUP 2: SECTION CLINICS

Oral Surgery, Exodontia and Anesthesia

"The Impacted Mandibular Third Molar"
Boyd S. Gardner.....Rochester, Minn.

"Surgical Repair of Defects of the Palate"
Henry S. Dunning.....New York City

Periodontia

"Treatment of Open Bite Cases"
Carl W. Hoffer.....Nashville, Tenn.

"Vincent's Infection"
S. Leonard Rosenthal...Philadelphia, Pa.

"Surgical Elimination of Pyorrhea"
H. A. Sebald.....Middletown, Ohio

"Casts in Periodontia Practice"
Isador Hirschfeld .....New York City

Histology, Physiology, Pathology, Bacteriology and Chemistry (Research)

"Practical Procedure for the Control of Dental Caries"
Weston A. Price.....Cleveland, Ohio

"Histology and Bacteriology of the Enamel Surface"
Basil G. Bibby.....Rochester, N. Y.

"Original Method of Securing Oral Tissues for Histopathologic Studies"
James L. Zemsky.....New York City

GROUP 3: STATE ASSOCIATION INDIVIDUAL CLINICS AND GROUP CLINICS

California

"Correlation of Medical and Dental Findings in Diagnosis"
Don J. Aubertine.....San Francisco

"Infections in Deciduous Teeth"
John E. Gurley.....San Francisco

California (Southern)

"Practical and Simple Method of Balancing Full Dentures"
E. R. Brownson.....Los Angeles

"Operative Procedure in Children's Dentistry"
F. E. Hogeboom.....Los Angeles

"Practical Method of Constructing Continuous Gum Denture" (Moving Picture)
James L. Howard.....Los Angeles

"Technic of Oralogic Diagnosis"
Frank Kaiser .....Los Angeles

"Accurate Partial Dentures"
Alexander S. Lehman.....Los Angeles

"Reconstructive Plastic Oral Surgery"
Arthur E. Smith.....Los Angeles

"New and Simple Instruments for Obtaining and Transferring Condylar Positions and Movements"
Harry A. Bonoff.....Los Angeles

"Constructing an Upper and Lower Case" (Moving Picture)
Warren C. Garnhart.....Los Angeles

"Root Canal Technic"
John P. Buckley.....Los Angeles

Delaware

"Porcelain Inlay-Gold Inlay Combination for the Bicuspids"
Robert E. Price.....Wilmington

District of Columbia

"Immediate Denture and Phases of Full Denture Prosthesis"
S. S. Jaffe.....Washington

"Duplication of Models and Removable Bite Plane"
Paul W. Hoffman.....Washington

GROUP CLINIC:

SURGICAL ELIMINATION OF PYORRHEA ALVEOLARIS

"Clinical Aspect"
Arthur B. Crane.....Washington

"Clinical Aspect"
Harry Kaplan .....Washington

"Microscopic Aspect"
James B. Mann.....Washington

Florida

"Dental Medicine"
M. Francis Wielage.....Miami

Illinois

"Pyorrhea"
Bernard D. Friedman.....Chicago

"Full Denture Impression Technic"
Donald F. Cole.....Chicago

"Office Management"
Olaf J. Olafsson.....Chicago

"Fixed Bridgework"
Stanley D. Tylman.....Chicago

"Root Canal Therapy"
Robert G. Kesel.....Chicago

"Crown and Bridgework"
Harold W. Oppice.....Chicago

"Children's Dentistry"
Corvin F. Stine.....Chicago

"Early Diagnosis of Malocclusion"
Leland R. Johnson.....Chicago

"Inlays"
William A. Hocker.....Chicago

"Full Dentures"
Earl L. Richey.....Chicago

"A Comparison of Roentgenograms with Pathologic Specimens"
Edward H. Hatton.....Chicago

"Full Dentures"
Rudolph O. Schlosser.....Chicago

"Inlays"
Victor T. Nylander.....Chicago

"New Technic for Making Facial Masks in Natural Color"
R. H. Johnson.....Chicago

"Partial Dentures and Removable Bridgework"
Henry Glupker .....Chicago

"Technic for a Sutureless Flap in Difficult Single Extractions"
George Schneider .....LaSalle

"Pit and Fissure Cavity Preparation for Gold Foil Fillings"
Lloyd C. Blackman.....Elgin

"An Indirect Inlay Technic"
R. H. Dixon.....Arthur

"Examples of a Technic of Proven Economic Value in the Interception of Malocclusion"
R. C. Willett.....Peoria

GROUP CLINICS:

"Office Efficiency"
Dental Assistants Association...Chicago

Indiana

"Experimental Castings"
Robert K. George.....Indianapolis

"Thermal Investment Expansion"
Gerald A. Hiatt.....Indianapolis

GROUP CLINIC:

"Removal of Teeth by Open Dissection"
S. W. Shields.....Indianapolis
F. G. Heimlich.....Indianapolis

Iowa

"Surgical Pyorrhea and Gum Stimulation with the Toothbrush and Other Stimulating Instruments"
W. J. Charters.....Des Moines

GROUP CLINIC:

"Practical Application of Prevention in Orthodontia"
C. S. Foster.....Cedar Rapids
C. V. Lehman.....Cedar Rapids

Kentucky

"Treatment of Incipient Caries"
H. K. Kellogg.....Louisville

"Fixed Bridge Attachments Preserving Contact"
Edward H. Hubbuch.....Louisville

"Method of Rebasing Dentures"
McFerran Crowe .....Lexington

"New Orthodontic Mechanism: Wire Automatic Appliance"
J. Brooks Juett.....Lexington

Maine

"Crowns and Bridgework"
George J. Anderson.....Portland

"Orthodontia"
Albert Johnson .....Portland

Maryland

"Removal and Replacement of Orthodontic Appliances by the General Practitioner as an Emergency Requirement or for Prophylaxis"
H. E. Kelsey.....Baltimore, Md.

Massachusetts

"Gold Inlay"
Horace E. Pope.....Beverly

"Phonetics and Cleft Palate"
John J. Fitzgibbon.....Holyoke

"Natural Development of the Arches, During a Seven-Year Period of Observation, Beginning with Preschool Age"
Shinji Fujishiro .....Boston

"Orthodontic Appliances and Retainers"
Paul H. Newhall.....Boston

"All Porcelain Bridges; Porcelain Three-Quarter Veneer Crowns"
Mitsuta Manabe .....Boston

"Three-Quarter Veneer Crowns from the Standpoint of Pulp Conservation"
Lawrence M. Staples.....Boston

"Standardization and Reduction in Profile Roentgenograms"
Herbert I. Margolis.....Boston

"Development of the Lingual Arch and Finger Springs"
Edward I. Silver.....Boston

"Fractures of the Jaws and Fixation Without Wiring"
Louis Gross .....Pittsfield

"New Semiveneer Crown and Bridge Attachment"
Harmon A. Shohet.....Boston

"Alveolectomy with Reference to Full Denture Construction"
George J. Fink.....Boston

"Conservative Treatment of Cysts"
Julius H. Levine.....Boston

GROUP CLINIC:

"Teaching Clinic for Carving Three-Quarter Cavity Preparation on a Typical Cuspid Tooth"
By the Attleboro Clinic Club

Walter E. Briggs.....Attleboro
Jonathan Edwards...North Attleboro
John W. Hotchkiss.....Attleboro
Ralph H. Metters....North Attleboro
W. Earl Turner.....Marion
Arthur J. Sparks.....Attleboro

Michigan

"Porcelain Inlays and Crowns"
A. J. Norman.....Detroit

"Gold Inlays and Crowns"
W. J. Beuthien.....Detroit

"Bridges"
W. N. Moffett.....Detroit

"Partial Dentures"
P. M. Kyprie.....Detroit

"Full Dentures"
Charles Lane .....Detroit

"Basket Clasp Attachment and Its Application to Orthodontia"
Barnett Malbin .....Detroit

GROUP CLINIC:

"A Simplified Technic of Greatest Accuracy for Cast Gold Inlays, Based Upon the Use of New Materials"
By the Travis Operative Dentistry Club

L. V. Kimbrell.....Detroit
P. S. Jeserich.....Ann Arbor
L. F. Rittershofer.....Ann Arbor
L. C. Schultz.....Detroit
A. A. Bartlett.....Detroit
J. J. Travis.....Ann Arbor

"The Dental Hygienist in the Office; in the Schools"
By Michigan State Dental Hygienists Society

Minnesota

"Meeting the Difficulties Encountered in Dental Surgery"
H. B. Clark.....St. Paul

"Casting to Dimensions"
E. L. Rice.....Minneapolis

"Posterior and Anterior Bridges for Deciduous Teeth"
C. W. Bierman.....Minneapolis

"Slotting Tray for Sectional Plaster Impressions"
Ralph H. Boos.....Minneapolis

"Cast Survey with Treatment of Abnormal Interdental Relation"
George W. Boos.....Minneapolis

"Abnormal Prosthetic Construction"
C. O. Flagstad.....Minneapolis

"Immediate Denture Service"
A. W. Simonson.....Minneapolis

"Practical Short Cuts in Full Cast Crown Construction"
C. L. Lynn.....Redwood Falls

GROUP CLINIC:

"Bridges Cast in One Piece"
F. S. Meyer.....Minneapolis
J. B. Towey.....Minneapolis
W. J. Von Bank.....New Ulm

Missouri

"Minor Oral Surgery"
R. W. Edwards.....Kansas City

"A New Mechanical Anatomic Tooth Form"
Dayton Dunbar Campbell...Kansas City

"Space Maintainers: Where Indicated and Where Contraindicated"
E. H. Golden.....St. Louis, Mo.

"Distoclusion Involving Other Complications; Treatment for Correction"
Hugh G. Tanzey.....Kansas City, Mo.

New Jersey

"Movable-Removable Bridgework with Precision Attachments, and Stress Breakers"
Leon H. Fradkin.....Montclair

"Method Employed for Obtaining Space for Impacted or Unerupted Teeth"
Richard Lowy .....Newark

"A Nonrigid Lock and Orthodontia Appliance"
Charles S. Hardy.....Summit

"Full Dentures"
Albert A. Harrington.....Newark

"Impressions"
Ernest C. Reock.....Belleville

"Cavity Preparation for the Inlay Abutment"
Jacob Schaffer .....Newark

"Drugs and Their Use by the General Practitioner"
E. J. H. Schneider.....Maplewood

New York

"Practical Demonstration of Opening the Bite"
Justin W. Bourquin.....Olean

"Restoring the Teeth with Better Amalgam"
John E. Sweeney.....Olean

"Technic for Mixing and Insertion of Amalgam"
I. M. Kaiser.....Olean

"Better Fitting One-Piece Crowns and a Well-Made Open Face Crown"
L. F. Dietter.....Olean

"Gold Inlays"
Edward C. Weinz.....Syracuse

"Models, Photographs and Roentgenograms of Cases Treated with the Edgewise Arch Mechanism"
C. A. Sayers.....Syracuse

"Porcelain Jacket Crowns"
Daniel Jutton .....Syracuse

"Fracture Splints"
Dyer B. Talley.....Syracuse

"Radical Pyorrhea Operation and Methods of Brushing (Moving Picture); Clinical Demonstration of Postoperative Care by Hygienist"
A. C. Hitzelberger.....Utica

"Gold Inlays, Indirect Method"
W. G. Houghton.....Watertown

"Systematic Analyzing of Malocclusion and Treatment Planning"
Leon D. Bryant.....Syracuse

"Some Simple Applications of Elevators for the General Practitioner"
C. B. Frawley.....Syracuse

"Residual Infection"
G. H. Cole.....Watertown

"Ethyl Chlorid and Bromid Anesthesia"
H. C. McBrair.....Middletown

"Simplified Method for Making Gold Foil Fillings and Gold Foil Inlays Without Casting"
J. A. Daly.....New Rochelle

"Radium and Its Use in Oral Malignancy"
H. A. Solomon.....Buffalo

"Simple Space Retainers Used in Orthodontia"
Myron Roberts .....Buffalo

"Occlusion and Its Relation to Periodontal Diseases"
A. Arthur Lindbloom.....Jamestown

"Vincent's Infection"
L. Halliday Meisburger.....Buffalo

"Attachment for Impacted Teeth in Applying Force for Tooth Movement"
Floyd E. Gibbon.....Buffalo

"One-Piece Lingual Arch, Tongue Locked, Stabilized by Recessed Anchor Lugs Used in Connection with the Labial Arch"
Walter H. Ellis.....Buffalo

"Variation of the Pinledge and Three-Quarter Crown"
Mark V. Conley.....Buffalo

"Protecting the Dental Tissues by Properly Made Anchor Bands and Arch Locks"
Herbert A. Pullen.....Buffalo

"Surgical Pyorrhea Clinic" (Millard Fillmore Hospital)
R. Leslie Murray.....Buffalo

"Dental Prescriptions"
Paul Jameson .....Buffalo

"Partial Dentures"
Walter F. Chappelle.....Buffalo

"Partial Dentures by Assembled Technic"
Robert J. Wilson.....Buffalo

"Dental Roentgenograms Showing Bone Regeneration Following Root Canal Treatment"
Paul B. Camp.....Jamestown

"Anterior Pin Inlay Construction for Bridgework"
William A. Manning.....Binghamton

"Technic for Root Removal"
Phillip J. Gorman.....Binghamton

"Splint for Fractured Jaw"
Lloyd S. Ingalls.....Cortland

"Applications of the Resilient Arch in Prevention and Treatment of Malocclusion"
Arthur L. Smith.....New York City

"Root Canal Therapy"
Jacob B. Schneer.....New York City

"Wax Patterns for Gold Inlays by the Direct Method"
Roy D. Ribble.....New York City

"Partial Dentures"
Samuel Doskow .....New York City

"Periodontia"
Sidney Sorrin .....New York City

"Phases of Porcelain"
Milton Cohen .....New York City

"Mouth Props and How to Make Them: An Aid to Operative Dentistry Especially in Children"
Arthur S. Litten.....New York City

"Some Essentials in Constructing Full Upper and Lower Dentures"
S. J. Schekter.....New York City

"Movable Fixed Bridgework"
Henry S. Wasserman.....New York City

"Periodontal Disease, Its Diagnosis and Control"
Samuel Charles Miller...New York City

"Accidents in Extraction; Methods for Their Prevention"
Samuel Birenbach .....New York City

"All Porcelain Bridgework, Porcelain Inlays and Porcelain Jacket Crowns"
H. Spalding Both.....New York City

"Partial Denture Gold Castings"
Victor H. Sears.....New York City

"Preventive Dentistry as Practiced by the Department of Health of New York City"
Harry Strusser .....New York City

"Contraindications for Orthodontic Treatment"
A. V. Greenstein.....New York City

"Avoidance of Failure of Amalgam Fillings Through a Proper Technic"
Benjamin Kornfeld .....New York City

"Technic for Permanently Recording Infections of Root Canals, as a Guide to Treatment"
E. G. Van Valey.....New York City

"Technical Procedure of Interest to the General Practitioner Relative to Preventive Orthodontia"
Edward M. Griffin.....New York City

"Porcelain Restoration"
William A. Spring.....New York City

"Difficult Partial Restorations"
L. W. Doxtater.....New York City

"Detection of Proximal Caries by Means of the Roentgen Rays"
E. J. Nestler.....New York City

"Cohesive Gold Foil Manipulation Simplified"
LeRoy L. Hartman.....New York City

"Full Denture Correction Maintenance"
Henry I. Rothschild.....Buffalo

"How to Awaken the Patient's Interest and Gain His Cooperation in Daily Care of the Mouth"
M. C. Bradley.....Rochester

"Radiodontia"
Ralph S. Voorhees, Jr.....Rochester

"Giant-Cell Sarcoma"
D. C. Padelford.....Rochester

"Radio Broadcasting"
Harold D. Bowman.....Rochester

"Orthodontia for the General Practitioner"
Willard A. Gray.....Rochester

"Children's Dentistry"
Elmer J. Pammenter.....Rochester

"Gas Analgesia"
L. L. Mulcahy.....Batavia

"Second Pressure Method of Securing Atmospheric Pressure for the Retention of Full Lower Dentures"
D. H. Young.....Attica

"Method of Determining Exact Location of Retained Roots in Edentulous Mouths"
E. A. MacMinn.....Oakfield

"Inlays"
Gordon C. Peck.....Glenn Falls

"Cast Porcelain"
W. R. Eger.....Schenectady

"Facial Expression in Full Dentures"
H. O. Brown.....Rochester

"Method for Making an All Gold Anterior Pinlay Casting"
F. Teller Wilcox.....Schenectady

"Dentistry for Tuberculous Patients, with Special Reference to County Sanatoriums"
F. Paquette McCarthy.....Schenectady

"Ultraviolet Rays"
P. S. Lalonde.....Rochester

"Preparing Slides of Mouth Smears for Microscopic Examination"
Baines A. Goldblatt.....Rochester

"Medicaments"
John A. Jackson.....Rochester

"Spring Lock Bridge"
F. G. Neurohr.....New York City

"Orthodontic Observations"
Jerome H. Trier.....New York City

"Spring Lock Insertion Bridge and Its Construction: A New Principle in the Support and Retention of Movable, Removable Bridgework"
Paul Jones .....Rochester

"Modern Amalgam Technic"
F. A. Stewart.....New York City

"Lower Impression for Full Dentures"
Francis Scott Weir.....New York City

"Pedodontia"
Shirley H. Dwyer.....Brooklyn

"Unusual Method of Wax Manipulation for Indirect Inlays"
Warren L. Hafely.....Brooklyn

"Comprehensive Technic for Horizontal or Occlusal Studies of the Teeth"
J. B. Goldsmith.....New York City

"Waxing, Investing and Casting"
Emory C. Thompson.....Buffalo

"Slice Extension Cavity Preparation for Gold Inlays, with Indirect Method of Construction"
Maxwell D. Baxter.....New York City

"Oral Diagnosis"
Orville S. Long.....New York City

"Infiltration and Nerve-Blocking Injections"
Mendel Nevin .....Brooklyn

"Malocclusion Caused by the Prolonged Retention or the Premature Loss of the Deciduous Teeth"
Glenn H. Whitson.....Brooklyn

"Prosthetic Appliances as an Aid in Oral Surgery"
Edward T. Butler.....Buffalo

"Orthodontic Treatment"
Clifford G. Glaser.....Buffalo

"Carving and Investing Technic with the Use of Copper Bands for Onlays and Mesioclusodistal Inlays"
William G. Stanton.....Le Roy

"Continuous Lingual Clasp Partial Denture"
J. Galvin Woodworth.....Buffalo

"Conductive Anesthesia"
B. J. Wakefield.....Buffalo

"Technic for the Removal of Impacted Upper Cuspids"
C. E. Rose.....Buffalo

"Nutritional Guidance for Adult Patients"
William Stephenson .....Buffalo

"Practical Procedure for Deciduous Teeth"
Fred Metzger .....Buffalo

"Why Pyorrhea?"
Armin H. Bode.....Buffalo

"Cleft Palate Appliances"
Elmer J. Knocke.....Buffalo

"Operative Technic in Dentistry for Children"
James J. Ailinger.....Buffalo

"Gold Castings, Liquid Wax Technic"
E. P. R. Ryan.....New York City

"A Review of the Principles of Dental Engineering and Surveying Balanced Occlusion"
Victor Stoll .....New York City

"Oral Surgery in Moving Pictures"
Bertram B. Machat.....Brooklyn

"Preparation of Cavities in Individual Restoration, or for Abutments to Serve as Retaining Elements for Fixed or Removable Bridges"
J. R. Schwartz.....Brooklyn

"Full Denture Procedure"
Floyd G. Rea.....Brooklyn

"A Prophylactodontic Instrument"
Henry C. Ferris.....New York City

"Effects on Occlusion of (*a*) Failure to Restore the Original Mesiodistal Diameter of Broken Down Deciduous Teeth and (*b*) Premature Loss of One or More Deciduous Teeth"
E. V. Morrison.....Brooklyn

"Cast Gold Matrix Crowns; Variations as to the Use of Porcelain Facings and Cusps"
Wesley W. Washburn.....Brooklyn

"Instrument Control in the Treatment of Root Canals"
Fred R. Adams.....New York City

"Indirect Gold Inlays; Recent Improvements in Technic"
William McGill Burns.....Brooklyn

"Esthetics and Tooth Selection"
Charles M. McNeely.....Brooklyn

"Immediate Prosthesis for Full Denture"
Amos G. Stiker.....Addison

"Cleft Palate Technic"
Leo T. Crowley.....Buffalo

"Local Anesthesia"
Sheridan C. Waite.....Buffalo

"Central Invisor and Cuspid Impaction Treated Orthodontically"
Burton A. Hoffman.....Buffalo

"Malocclusion: Interceptive Devices"
Leonard Kohn.....Brooklyn

"Orthodontic Diagnosis"
Harold E. Sippel.....Buffalo

"Study of the Abnormal Drifts of Teeth Due to Premature Loss of the Deciduous Teeth"
F. L. Stanton.....New York City

"Orthodontoscope: An Instrument Simplifying the Making of Dental Graphs"
L. M. Waugh.....New York City

GROUP CLINIC:

"Including Dentistry in the Small Budget"
Alfred Walker.....New York City
Waldo H. Mork.....New York City
Marion Hayes.....New York City

MOUNT SINAI HOSPITAL DENTAL GROUP OF NEW YORK CITY

"Dentomedical Problems in Hospital Practice; Dentomedical Diagnosis; Relation of Dental Foci to Systemic Disease"
Harry A. Goldberg.....New York City

"Presentation of Unusual Cases"
Ralph H. Brodsky.....New York City

"Dental Bacteriology; Methods of Taking Cultures and Smears; Preparation of Vaccines and Vaccine Therapy"
Nathaniel Freeman.....New York City

"Oral Surgery"
Joseph Schroff.....New York City

"Diagnosis and Treatment of Oral Lesions"
Leo S. Stern.....New York City

"Orthodontia"
Dennis D. Glucksman....New York City

SYDENHAM HOSPITAL ORAL SURGERY GROUP
(Theodor Blum, Director)

"Benign Tumors of the Jaws"
Herman L. Reiss.....Brooklyn

"Minor Oral Surgery"
William Meyer.....New York City

"Gas Oxygen Anesthesia"
Phillip E. Hildebrand....New York City

CITY OF NEW YORK, DEPARTMENT OF HOSPITALS

"Gas Oxygen Anesthesia"
Harry M. Seldin.....New York City

"Neoplasms of the Oral Cavity the Result of Poor Dentistry"
Charles Berger.....New York City

"Root Amputations for the General Practitioner"
Emanuel Blumenthal.....Brooklyn

"Routine for Hospital Surgery"
L. H. Faircloth.....Harlem

"Demonstrations on Dry Specimens Showing a Simplified Technic in Exodontia with Special Reference to the Recovery of Fractured Roots and Impacted Teeth"
M. H. Feldman.....New York City

"Gas Oxygen Anesthesia"
John A. Woodman.....New York City

"Phases and Treatment of Fracture of the Jaws"
Leo Hirsch.....New York City

"Removal of Broken Roots; Simplified Methods for the Removal of Difficult and Malposed Teeth"
Rudolph H. Reese.....Brooklyn

"Dental Examination Methods and Recording of Findings in the Hospital Cases"
Lawrence J. Dunn.....Brooklyn

BUFFALO PROSTHETIC CLUB (PROGRESSIVE CLINIC)

"Technic of Full Denture Construction"
H. E. Reynolds, W. J. Burley, Edgar L. Ruffing, David T. Main, H. T. Gallagher, E. J. Farmer, C. M. Klipfel, Harold F. Meese, E. J. Doran, Ray L. Prior

BUFFALO ROUND TABLE STUDY CLUB

"Improved Methods of Mouth Preparation, Involving Impression Taking and Modified Partial Denture Designs"
J. L. Shaw, E. J. Doolittle, L. J. Gauchat, L. E. Gibbin, C. W. Weber, L. E. Leland, E. R. Melcher, E. F. Mimmack, P. W. Zillman

NEW YORK UNIVERSITY GROUP

"Differential Diagnosis in Restorative Cases in the Field Between Cases Definitely Requiring Fixed Bridgework and Those Definitely Requiring Removable Cases"
Clyde H. Schuyler.....New York City
Karl W. Knapp.....New York City

GUGGENHEIM DENTAL CLINIC OF NEW YORK CITY

"Presentation, Records, Equipment and Methods"
John Oppie McCall.....New York City
Thomas S. Petersen.....New York City

PRESBYTERIAN HOSPITAL GROUP

"Dental Service in the Presbyterian Hospital, New York City"
William Dwight Tracy...New York City

"Preparation and Impression for Porcelain Jacket Crowns to Meet the Needs of Dental Laboratories"
Albert B. Cutler.....Buffalo
J. L. Cleveland.....Buffalo

North Carolina

"Cast Joints, Fixed-Movable Bridges and Cast Gold Shell Crowns"
Frank O. Alford.....Charlotte

"Impressions"
Ralph F. Jarrett.....Charlotte

"Technic Used in General Extractions and Impactions Together, with Postoperative Treatment"
N. P. Maddux.....Ashville

Ohio

"Bridge Abutments"
Henry Steuer .....Cleveland

"Incisal Guidance"
L. G. Jordon.....Cleveland

"Fixed Bridge Pontics"
Fred J. Beutel.....Cleveland

"Precision Casting Utilizing the Hydroscopic Action of Plaster Investments in Making Expanded Molds"
C. H. Scheu.....Lakewood

"Castings"
Stanley L. Kiley.....Lakewood

"Treatment of Fractures of Mandible and Maxilla"
Paul J. Aufderheide.....Cleveland

"Accurate Models for Indirect Inlays"
W. Lorne Smith.....Lakewood

"Oral Surgery Cases"
Bertrand S. Rothwell.....Cleveland

"Rebasing Technic for Full Upper and Lower Dentures"
C. C. Gregg.....Rittman

"Gold Soldered Pontics"
W. A. Knoderer.....Akron

"Partial Lower Modeling Compound Impressions"
A. S. Butler.....Akron

"Intra-Oral Splinting for the Control of Fractured Mandibles"
R. A. Ober.....Akron

"Roofless Dentures; Swaged Metal Plate"
Lee W. Atkinson.....Salem

"An Important Phase of Oral Diagnosis"
S. W. Brown.....Ashtabula

"Determining Centric Occlusion, with a Check-Up as to Its Correctness in Balanced Relation"
L. Langdon Sheffield.....Toledo

"A Review of Modeling Compound Impression Technic"
T. S. Shaw.....Toledo

GROUP CLINIC:

"Removal of Deeply Submerged Mandibular Third Molars in Elderly Patients"
F. M. Deuschle.....Cincinnati
Hugh W. MacMillan.....Cincinnati

Oklahoma

"Positive Technic to Be Used in Taking an Impression for a Pinledge Attachment"
John N. Glass.....Tulsa

Pennsylvania

"Some Simplified Forms of Orthodontic Appliances Useful to the Man in General Practice"

Andrew F. Jackson.....Philadelphia

"Treatment of Adult Open-Bite Cases; Treatment of Deep Overbite"
Harry C. Metz.....Pittsburgh

"Porcelain Inlays"
H. W. Brandt.....Scranton

"Exodontia"
E. L. Brown.....Scranton

"Rational Treatment of Pyorrhea"
E. J. Donnegan.....Scranton

"Time Factor in Dental Castings"
R. A. Goodall.....Scranton

"Treatment of Accidents in Exodontia for the General Practitioner"
J. Paul Jones.....Scranton

"Porcelain Inlays"
Saul Levy.....Scranton

"Orthodontia"
F. W. Nash.....Scranton

"Manipulation of Dental Solders"
A. D. Preston.....Scranton

"Indirect Method of Making Porcelain Inlays, Including Bicuspid and Molar"
D. S. Gardner.....Scranton

"Various Types of Compensating Attachments for Movable Clasps, Occlusal Rests and Lugs for Dentures"
Rupert G. Beale.....Philadelphia

"Phases of Orthodontia the General Practitioner Should Know"
Aubrey P. Sagar.....Philadelphia

"Instant Prosthetic Replacements; Casts Depicting Tabular Ridge Form Rather than Circular"
M. M. Devan.....Philadelphia

"Ceramics for the General Practitioner; a New Method of Condensation of Porcelains"
Benjamin A. Lincoln.....Philadelphia

"Silver Alloy Inlay Restoration"
O. M. Mierley.....Huntingdon

"Treatment of Fractures of Maxilla and Mandible"
J. A. Gardner.....Pittsburgh

"Cavity Preparation for Corner Restoration of Anterior Teeth with Gold Inlays"
Ross Porter.....Oil City

"Eliminating Certain Difficulties Associated with Construction of Lower Dentures"
Harvey D. Roberts.....Johnsonburg

"Some Important Considerations in the Administration of Nitrous Oxid-Oxygen Anesthesia"
W. Harry Archer.....Pittsburgh

"Fixed Bridgework"
A. C. Young.....Pittsburgh

"Porcelain Inlay Technic"
Edward R. Baker.....Erie

"Unusual Cysts in Maxilla and Mandible"
Ralph E. Ward.....Erie

"Interpretation of Bitewing Films"
M. Lee Tarno.....Erie

Rhode Island

"Progressive Malocclusion" (One hundred models)
Ira B. Stilson.....Providence

South Carolina

"Full Dentures"
J. A. S. Pike.....Columbia

"Exodontia"
M. L. Brockington.....Florence

"Orthodontia"
T. C. Sparks.....Columbia

"Cast Gold Inlays"
W. R. Craig.....Walhalla

"Pontic Bridge Work"
E. F. Mickle.....Columbia

"Roentgenograms"
G. C. Albright.....Greenville

South Dakota

"Full Denture Impressions"
R. W. Ellis.....Salem

"Casting Technic for Gold Inlays"
H. G. Tarbell.....Watertown

Texas

"Anterior Restoration with Porcelain"
B. F. Thielen.....Paris

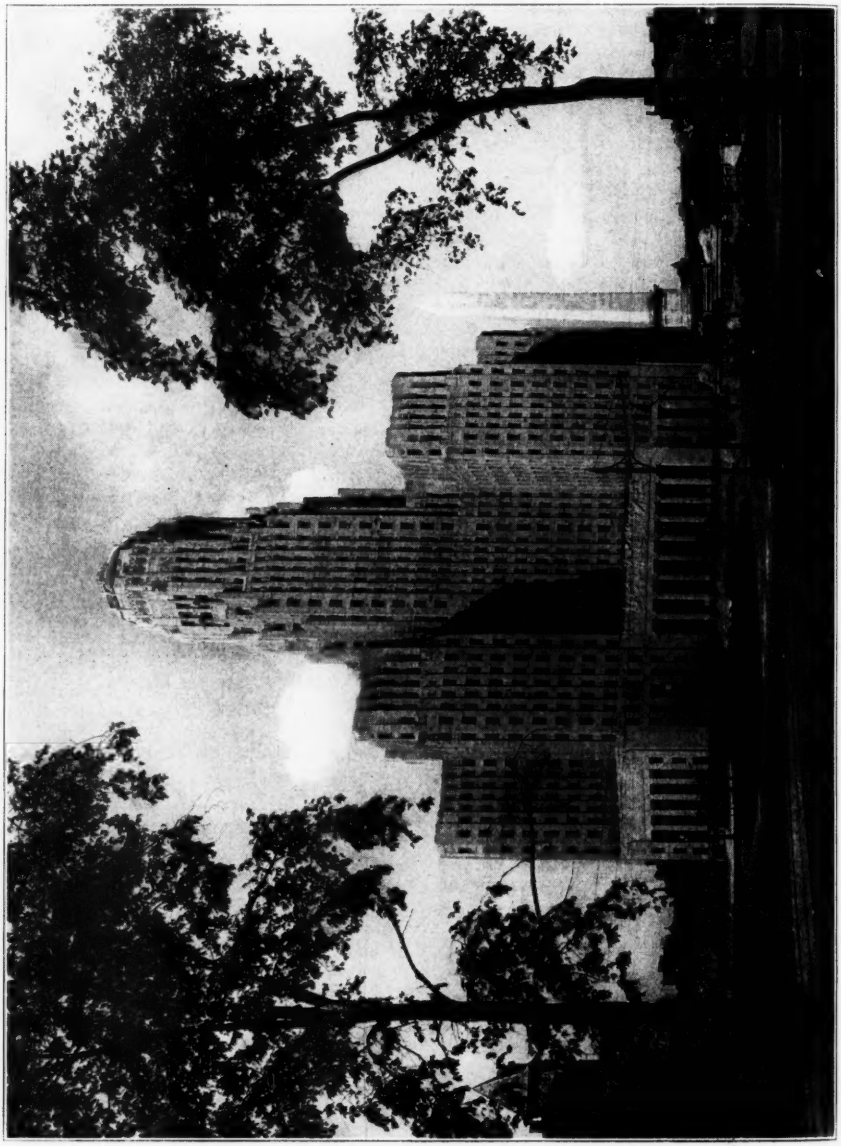
"Casting Technic"
F. W. Hinds.....Dallas

Wisconsin

"Simple Method of Causing Impacted Teeth to Erupt in Position"
Alfred A. Meurer.....Milwaukee

Canada

"A Practical Method of Adapting Record Card to Visible Filing System"
G. Vernon Fisk.....Toronto, Canada



City Hall, Buffalo

THE BUFFALO SESSION

RADIO PROGRAM

Tuesday, September 13, 1:00-1:15 p. m.

WGR, "Dental Care and Health," George H. Wandel, Chicago, Ill.

WBEN and WKBW, Greater Buffalo Ad Club Luncheon Talk: "Dentistry in the Various Health Services of the U. S. Government," C. T. Messner, Washington, D. C.

Wednesday, September 14

WBEN, Mouth Hygiene Luncheon Talk: "Establishment of the Eastman Dental Clinics in Europe," Harvey J. Burkhart, Rochester, N. Y.

"Care of Children's Teeth as a Solution of Dental Problems in Adults"
F. Blaine Rhobotham.....Chicago, Ill.

WGR (6:15-6:30 p. m.), "Dentistry in the Field of Public Health," William R. Davis, Lansing, Mich.

Thursday, September 15

WGR (1:00-1:15 p. m.), "The Child and His Teeth," Frank A. Delabarre, Boston, Mass.

WKBW, Rotary Club of Buffalo Luncheon Talk: "Accomplishments and Aims of Organized Dentistry," Arthur D. Black, Chicago, Ill.

(The luncheon programs of the Rotary Club, Kiwanis Club, Greater Buffalo Ad Club and the Mouth Hygiene Luncheon will be broadcast.)

LUNCHEON CLUB PROGRAM

Monday, September 12, 12:15 p. m.

Marshall Club, Hotel Statler.
Optimist Club, Gandy's.
Quota Club, Hotel Statler.

Tuesday, September 13, 12:15 p. m.

Greater Buffalo Ad Club, Hotel LaFayette.
Zonta Club, Hotel Statler.

Wednesday, September 14, 12:15 p. m.

Kiwanis Club, Hotel Statler.
Masonic Past Masters Association, Hotel LaFayette.

Thursday, September 15, 12:15 p. m.

Rotary Club of Buffalo, Hotel Statler.

LUNCHEON PROGRAM

Monday, September 12

DENTAL SOCIETY OF THE STATE OF NEW YORK

A luncheon will be given to the Officers, Trustees, Delegates and Section Officers of the American Dental Association at 12:30 at the Hotel Statler, by the Dental Society of the State of New York.

WOMEN'S AUXILIARY LUNCHEON

The annual luncheon of the Women's Auxiliary of the American Dental Association will be given at 1:00 p. m. at the Hotel Statler.

Tuesday, September 13

AMERICAN DENTAL ASSOCIATION PAST PRESIDENTS' LUNCHEON

The Past Presidents' Club of the American Dental Association will hold its annual luncheon at 12:30 p. m. at the Hotel Statler.

Wednesday, September 14

WOMEN'S LUNCHEON

At 1:00 p. m. in the Hotel Statler ballroom, the women attending the A. D. A. will be entertained at luncheon. Admission by ticket only.

MOUTH HYGIENE LUNCHEON

The Annual Mouth Hygiene Luncheon will be held at 12:15 p. m., Hotel Statler, Chinese Room. The American Society for the Promotion of Children's Dentistry, American Dental Hygienists' Association and American Dental Assistants Association will participate.

SCHOOL PROGRAM

Tuesday, September 13

Public School No. 78,
345 Olympic Ave..... 9:00 a. m.
George P. Cousins, Chicago, Ill.

St. Ann, 371 Watson St..... 9:00 a. m.
F. L. Adams, Tampa, Fla.

Mt. Mercy, 1425 Abbott Road.... 9:00 a. m.
George Stratton, Oshkosh, Wis.

St. Mary's Seminary,
564 Franklin St..... 9:00 a. m.
C. L. Drain, Iowa City, Iowa

St. Mary of Sorrows,
335 Guilford Ave..... 9:00 a. m.
N. Talley Ballou, Richmond, Va.

St. Bartholomew,
194 Ludington St..... 9:00 a. m.
Leo J. Schoeny, New Orleans, La.

City Hall, Buffalo

Wednesday, September 14

Public School No. 81,
Tacoma and Delaware Ave.... 9:00 a. m.
Harry S. Thomson, Toronto, Canada

Annunciation, 18 Greenwood Pl... 9:00 a. m.
F. E. Hogeboom, Los Angeles, Calif.

St. James, 10 Hastings Street..... 9:00 a. m.
A. C. Thompson, Detroit, Mich.

Nativity, 20 Herkimer Street..... 9:00 a. m.
Harry Strusser, New York City

St. Nicholas, 18 Welker St..... 9:00 a. m.
S. D. Harris, Detroit, Mich.

Holy Family, 556 South Park Ave. 9:00 a. m.
W. T. McFall, Macon, Ga.

Public School No. 74,
Northland & Wohlers Ave..... 9:00 a. m.
John E. Gurley, San Francisco, Calif.

Thursday, September 15

Public School No. 3,
Porter Ave. and Niagara St.... 9:00 a. m.
Lon W. Morrey, Chicago, Ill.

St. Gerard, 1190 E. Delavan Ave.. 9:00 a. m.
H. Shirley Dwyer, Brooklyn, N. Y.

St. Theresa, 1974 Seneca St..... 9:00 a. m.
Margaret Jeffrey, Harrisburg, Pa.

Mt. St. Joseph, 2064 Main St..... 9:00 a. m.
William R. Davis, Lansing, Mich.

St. Brigid, 319 Louisiana Ave..... 9:00 a. m.
N. G. Slaughter, Athens, Ga.

St. Margaret, 1395 Hertel Ave.... 9:00 a. m.
Henry Cline Fixott, Portland, Ore.

WOMEN'S PROGRAM

Monday, September 12

10:30 a. m. Annual Business Meeting, Women's Auxiliary of the American Dental Association, Parlor D, Hotel Statler.

1:00 p. m. Annual Luncheon of the Women's Auxiliary of the American Dental Association, Hotel Statler, Iroquois Room.

10:00 p. m. Informal Dance in the Ballroom of the Hotel Statler.

Tuesday, September 13

9:30 a. m. First General Session of the American Dental Association in the Ballroom, Hotel Statler.

7:45 p. m. Second General Session of the American Dental Association in the Ballroom, Hotel Statler.

Wednesday, September 14

1:00 p. m. Luncheon, Ballroom, Hotel Statler; admission by ticket only. Members of the A. D. A. should secure tickets on registration.

7:45 p. m. Third General Session of the American Dental Association in the Ballroom, Hotel Statler.

Thursday, September 15

9:30 p. m. Formal ball in honor of the retiring President, Martin Dewey, in the Ballroom, Hotel Statler.

Trips to Niagara Falls

Every day at your convenience, a trip may be taken to Niagara Falls, at the rate of $2. Comfortable automobiles will leave the Hotel Statler on the hour. En route, you will pass St. Paul's Cathedral, the Soldiers and Sailors Monument, the McKinley Monument and the City Hall. Arriving at the Front, the historic spot where Fort Porter once stood and soldiers defended our country against invaders, the route leads over the Niagara River via the Peace Bridge, entering Canada at Fort Erie, thence down the beautiful Canadian Boulevard, stretching away toward Niagara Falls along the shores of the Niagara River. Arriving at Niagara Falls, you will be shown many points of historic and commercial interest and the falls of the mighty Niagara. Of the many natural wonders to be seen here are the Gorge, the Cave of the Winds, Victoria Park, Prospect Park and the Whirlpool. Another attraction is the trip in the Maid-of-the-Mist, which journeys from its landing below the Falls, up the Niagara River, affording a view of the cataract and an idea of its height and its power. On the American shore, the Gorge route takes you down through this magnificent scenic canyon, past the rapids of the lower Niagara and the great Whirlpool. There are historic villages to visit in this vicinity, namely, Lewiston, Queenstown Heights and Old Fort Niagara. The return trip is made from Niagara Falls, upon American soil, entering Buffalo through its beautiful park system and passing through the most exclusive residential sections of the city.

SCIENTIFIC EXHIBITS

1. Northwestern University Dental School, Chicago, Ill.

2. University of Illinois, College of Dentistry, Chicago, Ill.
3. Ohio State University, College of Dentistry, Columbus, Ohio.
4. Baylor University, College of Dentistry, Dallas, Texas.
5. University of Louisville, College of Dentistry, Louisville, Ky.
6. American Society for the Control of Cancer, New York City.
7. University of Pennsylvania, School of Medicine, Philadelphia, Pa.
8. The American Social Hygiene Association, New York City.
9. Forsyth Dental Infirmary, Boston, Mass.
10. Wilton W. Cogswell, Colorado Springs, Colo.
11. Buffalo Health Department, Buffalo, N.Y.
12. L. M. Waugh, New York City.
13. National Bureau of Standards, A. D. A. Research Fellowship, Washington, D.C.
14. Rutgers University, New Jersey College of Pharmacy, Newark, N. J.
15. Council on Dental Therapeutics and Bureau of Chemistry, American Dental Association, Chicago, Ill.

HEALTH EXHIBITS

1. Forsyth Dental Infirmary, Boston, Mass.
2. Rochester Dental Dispensary, Rochester, N. Y.
3. Preparedness League of American Dentists.
4. Metropolitan Life Insurance Company, New York City.
5. Shelby County Health Department, Memphis, Tenn.
6. U. S. Public Health Service, Washington, D. C.
7. American Dental Hygienists' Association.
8. American Dental Assistants Association.
9. State Board of Health, Dover, Del.
10. American Dental Association.

ANNOUNCEMENTS

PAST PRESIDENTS' (A. D. A.) CLUB LUNCHEON

The Past Presidents' Club of the American Dental Association will hold its annual luncheon at 12:30 p. m., Tuesday, September 13, at the Hotel Statler. R. Boyd Bogle will be the presiding officer and the annual address will be delivered by William H. G. Logan.

HOMER C. BROWN, *Secretary*,
Hartman Building,
Columbus. Ohio.

RESEARCH COMMISSION

The Research Commission will hold the first session of its annual meeting at the Hotel Statler, 2:00 p. m., Sunday, September 11. All members are requested to be present.

HOMER C. BROWN, *Secretary*.

MOUTH HYGIENE LUNCHEON

The Annual Mouth Hygiene Luncheon of the American Dental Association will be held in the Chinese Room of the Hotel Statler, Wednesday, September 14, at 12:15 p. m. This year the American Society for the Promotion of Children's Dentistry; the American Dental Hygienists' Association and the American Dental Assistants Association are participating in this luncheon. The speaker for the luncheon will be Harvey J. Burkhart, of Rochester, N. Y., who will talk on the establishment of the Eastman Dental clinics in Europe. Tickets will be on sale at the Armory and the Hotel Statler for $1.25 each. Tickets may be purchased in advance by writing the chairman of the Health Exhibits Committee, 1839 Hotel Statler, Buffalo, N. Y., and enclosing check or money order.

DENTAL SOCIETY OF THE STATE OF NEW YORK LUNCHEON

A luncheon will be given to the Officers, Trustees, Delegates and Section Officers of the American Dental Association, Monday, September 12, at the Hotel Statler, at 12:30 p. m., by the New York State Dental Society.

A breakfast meeting of the presidents, vice presidents, presidents-elect, secretaries and treasurers of each District of the New York State Dental Society is to be held in Parlor C, Hotel Statler, Tuesday morning, September 13, at 7:30 o'clock.

ASSOCIATION OF AMERICAN WOMEN DENTISTS

The Association of American Women Dentists will hold its eleventh annual meeting at the Hotel Statler, September 12, at 2:00 p. m. A banquet will be given at the Hotel Statler, at 6:30 p. m., September 12.

GENEVA E. GROTH, *Chairman*,
Publicity Committee.

NATIONAL ASSOCIATION OF DENTAL EXAMINERS

The National Association of Dental Examiners will hold its sixtieth annual convention at the Hotel Statler, beginning Saturday morning, September 10, at 9:00 a. m. Each board of dental examiners in the United States and Canada is invited. Each board belonging to the national association is expected to send one or all of its members as representatives to this meeting. Matters of importance and of state, interstate and international relation and application will be considered.

GEORGE L. POWERS, *Sec'y-Treas.*,
Memphis, Tenn.

CONJOINT BANQUET OF THE ASSOCIATION OF MILITARY DENTAL SURGEONS AND THE PREPAREDNESS LEAGUE OF AMERICAN DENTISTS

The Association of Military Dental Surgeons and the Preparedness League of American Dentists will hold a conjoint banquet, Wednesday evening, September 14, at 7:00 p. m., in the Chinese Room, Hotel Statler. All members and officers are invited to attend. The price of banquet tickets will be commensurate with economic conditions. The P. L. A. D. will also have an exhibit during the meeting. Write for reservations to Conjoint Banquet Committee, 1839 Hotel Statler, Buffalo, N. Y.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

The fourteenth annual meeting of the American Society of Oral Surgeons and Exodontists will be held September 9-10, with headquarters at the Hotel Buffalo.

HARRY BEAR, *Secretary*,
Richmond, Va.

AMERICAN ACADEMY OF PERIODONTOLOGY

The nineteenth annual meeting of the American Academy of Periodontology will be held at the LaFayette Hotel.

CLAYTON H. GRACEY, *Secretary*,
Fisher Bldg.,
Detroit, Mich.

AMERICAN FULL DENTURE SOCIETY

The American Full Denture Society will hold its fourth annual meeting September 9-10, at the Hotel Buffalo. The annual president's banquet will be held Friday evening, September 9.

H. L. HARRIS, *Sec'y-Treas.*,
Medical Arts Bldg.,
Minneapolis, Minn.

AMERICAN SOCIETY FOR THE PROMOTION OF CHILDREN'S DENTISTRY

The American Society for the Promotion of Children's Dentistry will hold its annual luncheon at the Hotel Statler, Thursday, September 15, 12:15 p. m., in the Iroquois room.

CHARLES A. SWEET, *Sec'y-Treas.*,
242 Moss Avenue,
Oakland, Calif.

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY

The meeting of the American Academy of Restorative Dentistry will be held September 11-12, at the Buffalo Athletic Club, with morning and afternoon sessions, and a luncheon on Sunday at noon, for members of the organization.

RALPH L. MORRISON, *Sec'y-Treas.*
The LaSalle,
Washington, D. C.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

The annual meeting of the American Dental Hygienists' Association will be held at the Hotel Lenox, September 12-16.

AGNES G. MORRIS, *Secretary*,
886 Main St.,
Bridgeport, Conn.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The American Dental Assistants Association will hold its eighth annual meeting at the LaFayette Hotel, September 12-15.

RUTH M. CLARK, *General Secretary*,
Scofield Building,
Minot, N. D.

WOMEN'S AUXILIARY OF THE AMERICAN DENTAL ASSOCIATION

The meeting of the Women's Auxiliary of the American Dental Association will be held at the Hotel Statler, September 12, at 10:30 a. m. Luncheon will be served at 1:00 p. m.

MRS. JOHN H. CADMUS, *Secretary*,
1163 Tower Road,
Hubbard Woods, Ill.

TRAPSHOOTERS LEAGUE OF THE AMERICAN DENTAL ASSOCIATION

The Trapshooters League of the American Dental Association will hold its tenth annual shoot at the Buffalo Trap and Field Club, September 12, at 1:00 p. m.

WILLIAM H. JORDAN, *Secretary,*
Kansas City, Mo.

AMERICAN DENTAL GOLF ASSOCIATION

The thirteenth annual tournament of the American Dental Golf Association will be held, September 12, with headquarters in the Hotel Statler. Championship and Calcutta events will be held at the Buffalo Country Club; Class B events will be played at the new Park Club, and Class C at the Meadowbrook Golf and Country Club. The Ladies tournament will be played at the Wanaka Country Club. Sunday evening, September 11, at 7:30 p. m., a banquet will be held in the Terrace Room of the Hotel Statler. Make reservations by writing Ernest W. Browning, 921 Boston Bldg., Salt Lake City, Utah.

PSI OMEGA FRATERNITY NATIONAL ALUMNI CHAPTER

The headquarters of the National Alumni Chapter of the Psi Omega Fraternity will be at the Buffalo Hotel. The annual banquet will be held September 12, at 6:30 p. m. at the Buffalo Hotel. All members and their woman guests will be welcome. The executive meeting will be held on September 13, 2:00 p. m. at Buffalo Hotel.

HAROLD S. SMITH, *Grand Recorder,*
180 North Michigan Ave.,
Chicago, Ill.

DELTA SIGMA DELTA FRATERNITY

The forty-eighth annual meeting of the Supreme Chapter of Delta Sigma Delta will be held September 12, beginning at 9:30 a. m. Luncheon will be followed by a business meeting and initiatory exercises. The annual banquet will be held at 6 p. m. at the Hotel LaFayette, which will also be the meeting place for all sessions. Those expecting to attend should get in touch with Edward F. Mimmack, 266 Bryant Street, Buffalo, N. Y., chairman of the hotel committee, or William E. Potter, 9 East Ferry Street, Buffalo, N. Y., chairman of the local arrangements committee.

By order of the Supreme Council,
H. HAMILL D. SWING, *Supreme Scribe.*

XI PSI PHI FRATERNITY

Xi Psi Phi annual banquet will be held September 12, at 6:00 p. m. at the Buffalo Athletic Club. All members of the fraternity and their wives are cordially invited to be present. (Informal.)

J. FRANKLYN COOK, *Supreme President,*
511 South Bonnie Brae Street,
Los Angeles, Calif.

ALPHA OMEGA FRATERNITY

The meeting of the Supreme Council has been called by the order of the Supreme Chancellor, September 12, at 2 p. m., at the Hotel Touraine, fraternity headquarters. All fraters attending the convention are requested to attend this meeting. Annual dinner at 6:30 p. m. The chairman of local arrangements is M. D. Wolfsohn, 131 Linwood Ave., Buffalo, N. Y.

RAILROAD RATES TO BUFFALO, N. Y.

The American Dental Association has discontinued the use of the Identification Convention Certificate, and again this year is using the "Certificate Plan." The certificates will be obtainable from your railroad agent, and NOT THROUGH THIS OFFICE. Following is full information regarding the plan.

The following directions are submitted for your guidance:

1. Be sure that when purchasing going ticket you request a CERTIFICATE. *Do not make the mistake of asking for a "Receipt."*

2. Present yourself at the railroad station for tickets and Certificates at least 30 minutes before departure of train on which you will begin your journey.

3. *Certificates are not kept at all stations.* If you inquire at your home station, you can ascertain whether Certificates and through tickets can be obtained to place of meeting. If not obtainable at your home station, the agent will inform you at what station they can be obtained. You can in such case purchase a local ticket to the station which has Certificates in stock, where you can purchase a through ticket and at the same time ask for and obtain a Certificate to place of meeting.

4. *Immediately on your arrival at the meeting present your Certificate* to the endorsing officer, Dr. John J. Ogden, Vice-President, as the reduced fares for the return journey will not apply unless you are properly identified as provided for by the Certificates.

5. *It has been arranged that the Special Agent of the Carriers will be in attendance on September 13 to 15 from 8:30 a. m. to 5:30 p. m., to validate Certificates.* If you arrive at the meeting later than September 15, after the Special Agent has left, you cannot have your Certificate validated and consequently you will not obtain the benefit of the reduction on the home journey.

6. Certificates issued to children at half fares will be counted the same as Certificates held by adults.

7. If your Certificate is duly validated, you will be entitled up to and including September 20 to a return ticket via the same route over which you made the going journey *at one-half of the regular one-way tariff fare* from the place of meeting to the point at which your Certificate was issued. *(The identical route must be used in going and in returning in order to benefit under the Certificate plan.)*

8. Return tickets issued at the reduced fares will not be good on any limited train on which such reduced fare transportation is not honored.

9. *No refund of fare will be made on account of failure to obtain proper Certificate when purchasing going tickets, nor on account of failure to present validated Certificate when purchasing return ticket.*

A program of exceptional merit has been arranged, and we extend to you a cordial invitation to be present.

Transportation Committee

O. J. SPECKER,
R. L. SPRAU,
HARRY W. NELSON,
E. J. JUSTIS,
H. B. PINNEY, *Chairman,*
212 East Superior Street, Chicago, Ill.

TRUNK LINE ASSOCIATION

Sale dates for New York State (east of and including Buffalo, Niagara Falls, Suspension Bridge and Salamanca), New Jersey, Pennsylvania (east of and including Erie, Oil City and Pittsburgh), Delaware, Maryland, District of Columbia, Virginia and West Virginia (east of and including Wheeling, Parkersburg, Kenova, Orange and Norfolk).....Sept. 7-13, Incl.

Final honoring date.....Sept. 20, 1932

TRANS-CONTINENTAL PASSENGER ASSOCIATION
WESTERN PASSENGER ASSOCIATION

Sale dates for Colorado (Julesburg only), Illinois, Iowa, Kansas, Manitoba (see note), Minnesota, Missouri, Nebraska, Northern Michigan, North Dakota, South Dakota, Wisconsin.....Sept. 7-13, Incl.

Colorado (except Julesburg), New Mexico, Wyoming.....Sept. 6-12, Incl.

Arizona, British Columbia, Idaho, Montana, Nevada, Utah, Oregon (except via California), Washington.....Sept. 5-11, Incl.

California.....Sept. 4-10, Incl.

Oregon (via California).....Sept. 3-9, Incl.

NOTE—Manitoba (on Great Nor., Nor. Pac. and M., St. P. & S. S. M. Rys., also from Winnipeg via Can. Nat'l and Can. Pac. Rys.)

Final honoring date.....Sept. 20, 1932

SOUTHEASTERN PASSENGER ASSOCIATION

Sale dates for points in territory (south of the Ohio and Potomac and east of the Mississippi Rivers).....Sept. 7-13, Incl.

Final honoring date.....Sept. 20, 1932

NEW ENGLAND PASSENGER ASSOCIATION

Sale dates for points in territory (New England).....Sept. 7-13, Incl.

Final honoring date.....Sept. 20, 1932

SOUTHWESTERN PASSENGER ASSOCIATION

Sale dates for Oklahoma, Texas.....Sept. 6-12, Incl.

Arkansas, Kansas, Louisiana, Missouri, also Memphis, Tenn., and Natchez, Miss.....Sept. 7-13, Incl.

Final honoring date.....Sept. 20, 1932

CENTRAL PASSENGER ASSOCIATION

Sale dates for points in territory (west of Buffalo, Niagara Falls, Salamanca, Pittsburgh, Wheeling, Parkersburg, and Kenova to and including Chicago and St. Louis, and north of the Ohio River, including Cincinnati, Louisville and Cairo).....Sept. 7-13, Incl.

Final honoring date.....Sept. 20, 1932

CANADIAN PASSENGER ASSOCIATION

Sale dates for points in Canada, East of and including Armstrong, Fort William and Sault Ste. Marie, Ont.....Sept. 7-13, Incl.

Final honoring date.....Sept. 20, 1932

VALIDATING DATES SEPT. 13-15

AMERICAN DENTAL ASSOCIATION

Buffalo, N. Y. Sept. 12-16, 1932.

HOTEL RESERVATIONS

In securing hotel reservations for the 1932 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation which has been made for you.

As your first choice may not be available, kindly indicate a second and a third choice. If none of these are available, the hotel manager will mail your application to the Chairman of Halls and Hotels Committee, who will make a reservation for you in as favorable a hotel as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel, releasing it, in order that your room may be available for other members.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, BUFFALO, N. Y., SEPT. 12-16, 1932.

.....Hotel. .....1932.
Buffalo, N. Y.

Please reserve sleeping room accommodations as noted below:

.....Room (s) with bath for.....people. Rate desired $.....
(per day)

.....Room (s) without bath for.....people. Rate desired $.....
(per day)

Second choice hotel.....

Third choice hotel.....

ROOMS TO BE OCCUPIED BY: ADDRESS IN FULL

Applicant..... .....

....

....

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. J. G. Roberts, Chairman Halls and Hotel Committee, 1839 Hotel Statler, Buffalo, N. Y., who will attend to the assignment of this reservation.

HOTEL	With Bath One Person	With Bath Two Persons	Without Bath One Person	Without Bath Two Persons
ARLINGTON				
136 Exchange		$5.00		$3.00
BUFFALO				
Washington and Swan	$3.00 S*	4.50 S		
	3.50 T&S	5.00 T&S		
	4.00 T&S	6.00 T&S		
	4.50 T&S	6.50 T&S		
		6.50 TB		
CHELTENHAM				
234 Franklin		3.00-5.00 TB	$1.50	
FAIRFAX				
Delaware near North		5.00-8.00		
		Suites 10.00-12.00		
FORD				
Delaware near Chippewa	2.00 S	3.50-4.00 TB		
		4.50 S, 3 persons		
		6.00 S, 4 persons		
		7.50 S, 5 persons		
GRAYSTONE				
24 Johnson Park		3.00-5.00		
		6.00 TB		
LAFAYETTE				
Washington and Clinton	3.50	5.00-6.00		
	4.00	7.00 TB		
LENNOX				
140 North	3.50	5.00-6.00 TB	2.00	3.50-4.00
MARKEEN				
Main and Utica	3.00	5.00		3.00
	5.00	6.00 TB		4.00 TB
STATLER				
Niagara Square	3.50	5.50		
	4.00	6.00		
	4.50	6.50		
	5.00	7.00 TB		
	6.00	8.00 TB		
	7.00	9.00 TB-10.00 TB		
STUYVESANT				
245 Elmwood	3.00	4.00		
		Suites 5.00		
		Suites 6.50		
TOURAINE				
Delaware and Johnson Park	3.00	5.00		
	3.50	6.00 TB		
WESTBROOK				
Delaware at North		Suites 6.00		
		Suites 8.50		
		Suites 9.00		
MEN'S HOTEL (Men only)				
308 Pearl			1.00	

*S, shower, T&S, tub and shower; TB, twin beds.

DIRECTORY OF COMMERCIAL EXHIBITS

Abbott Laboratories, 14th and Sheridan Rd., North Chicago, Ill.

American Cabinet Company, Two Rivers, Wis.

Ames Company, The W. V-B., 137 N. Adams St., Fremont, Ohio.

Ash, Claudius, Sons & Co., U. S. A., Inc., 127 Coit St., Irvington, N. J.

Boos, Henry P., 808 Nicollet Ave., Minneapolis, Minn.

Buffalo Dental Mfg. Co., 774 Main St., Buffalo, N. Y.

Butler, John O., Co., 7359 Cottage Grove Ave., Chicago, Ill.

Cameron's Surgical Specialty Co., 666 W. Division St., Chicago, Ill.

Carborundum Company, The, Niagara Falls, N. Y.

Castle, Wilmot, Co., 1159 University Ave., Rochester, N. Y.

Caulk Company, The L. D., Milford, Del.

Chayes Dental Instrument Corp., 332 E. 28th St., New York City.

Chicago X-Ray Film & Mount Co., 2532 Irving Park Blvd., Chicago, Ill.

Cleveland Dental Mfg. Co., 3307 Scranton Rd., S. W., Cleveland, Ohio.

Colgate-Palmolive-Peet Company, 919 N. Michigan Ave., Chicago, Ill.

Columbia Dental & X-Ray Co., 131 E. 23rd St., New York.

Columbus Dental Mfg. Co., The, Wager and Jackson Sts., Columbus, Ohio.

Corega Chemical Company, 208 St. Clair Ave., N. W., Cleveland, Ohio.

Corning Rubber Co., 266-270 Pearl St., Brooklyn, N. Y.

Crescent Dental Mfg. Co., 1832 S. Crawford Ave., Chicago, Ill.

Davis Company, The R. B., Hoboken, N. J.

Dee & Company, Thomas J., 55 E. Washington St., Chicago, Ill.

Dentists' Supply Co., 220 W. 42nd St., New York City.

Detroit Dental Mfg. Co., 6081 Twelfth St., Detroit, Mich.

Eastman Kodak Company, 341 State St., Rochester, N. Y.

Fasteeth, Incorporated, Binghamton, N. Y.

Friedman Specialty Co., 25 E. Washington St., Chicago, Ill.

Garhart Dental Specialty Co., 37 Union Square, Somerville, Mass.

General Electric X-Ray Co., 2012 Jackson Blvd., Chicago, Ill.

Hanau Engineering Co., 951 W. Ferry St., Buffalo, N. Y.

Heidbrink Co., The, 2633 Fourth Ave., Minneapolis, Minn.

Hood Company, John, 78 Tremont St., Boston, Mass.

Horlick's Malted Milk Corporation, Racine, Wis.

Hu-Friedy Mfg. Co., 3118 N. Rockwell St., Chicago, Ill.

Interstate Dental Co., 41 Union Square, New York City.

Iodent Chemical Company, 1535 Sixth St., Detroit, Mich.

Iteco Company, The, Broadway at Victoria, Portland, Ore.

Jelenko Company, J. F., 136 W. 52nd St., New York City.

Justi & Son, H. D., 33rd & Spring Garden Sts., Philadelphia, Pa.

King's Specialty Co., 135 E. Washington St., Fort Wayne, Ind.

Lavoris Chemical Co., 918 N. Third St., Minneapolis, Minn.

Lea and Febiger, 600 S. Washington Sq., Philadelphia, Pa.

McCaskey Register Co., The, South Union Ave., Alliance, Ohio.

McKesson Appliance Co., 2227 Ashland Ave., Toledo, Ohio.

Medical Protective Co., 360 N. Michigan Ave., Chicago, Ill.

Minimax Company, 185 N. Wabash Ave., Chicago, Ill.

Mizzy, Incorporated, 105 E. 16th St., New York City.

Moyer Company, Inc., The J. Bird, 1212 Vine St., Philadelphia, Pa.

Ney Company, The J. M., 71 Elm Street, Hardford, Conn.

Novocol Chemical Company, 2921 Atlantic Ave., Brooklyn, N. Y.

Pelton & Crane Co., The, 632 Harper Ave., Detroit, Mich.

Ransom & Randolph Co., The, Toledo, Ohio.

Ritter Dental Mfg. Co., Inc., 404 West Ave., Rochester, N. Y.

Silv-O-Dent Company, 652½ Alberta St., Portland, Ore.

Smith, Lee S., & Son Mfg. Co., 7326 Penn Ave., Pittsburgh, Pa.

Specialty Mfg. Company, 39 Front St., Brooklyn, N. Y.

Spyco Smelting & Refining Co., 55 S. Third St., Minneapolis, Minn.

Squibb & Sons Co., E. R., 745 Fifth Ave., New York City.

Tailby-Nason Company, 49 Amherst St., Boston, Mass.

Universal Dental Company, 48th & Brown Sts., Philadelphia, Pa.

Waite & Bartlett Mfg. Co., 53 Jackson Ave., Long Island City, N. Y.

Wernet Dental Mfg. Co., 220 36th St., Brooklyn, N. Y.

Westinghouse X-Ray Company, Inc., Long Island City, N. Y.

White Dental Mfg. Co., The S. S., 211 S. 12th St., Philadelphia, Pa.

Williams Gold Refining Co., 2978 Main St., Buffalo, N. Y.

Wilmot Castle Company, 1159 University Ave., Rochester, N. Y.

Peace Bridge, Buffalo, connecting the United States and Canada

MEMBERS OF THE HOUSE OF DELEGATES 1932

DELEGATES AND ALTERNATES

ALABAMA

Delegates

Olin Kirkland, Montgomery
C. G. Dillard, Huntsville

Alternates

J. A. Blue, Empire Bldg., Birmingham
W. S. Wilson, Fairfield

CALIFORNIA STATE

Delegates

Vernon L. Hunt, Arcata
Arthur R. McDowell, 344 14th St., San Francisco
Wilfred H. Robinson, American Bank Bldg., Oakland
John E. Gurley, 350 Post St., San Francisco
Kenneth I. Nesbitt, 450 Sutter St., San Francisco
Charles A. Sweet, 242 Moss Ave., Oakland

CALIFORNIA—SOUTHERN

Delegates

C. M. Benbrook, Auditorium Bldg., Los Angeles
John P. Buckley, 803 Taft Bldg., Hollywood
J. Franklyn Cook, 511 Bonnie Brae St., Los Angeles
L. E. Ford, 122 E. 16th St., Los Angeles
E. Ray Brownson, 912 Roosevelt Bldg., Los Angeles
W. S. Thompson, 707 S. Hill St., Los Angeles
Bert Boyd, Story Bldg., Los Angeles
Nye W. Goodman, Story Bldg., Los Angeles

Alternates

F. E. Hogeboom, 1203 Pellissier Bldg., Los Angeles
Frank Kaiser, 1217 Roosevelt Bldg., Los Angeles
J. E. Paul, 411 Moore Bldg., Santa Ana
A. T. White, Security Bldg., Pasadena
Henry L. Harris, 921 Union Bank Bldg., Los Angeles
B. B. McCollum, 1052 W. 6th St., Los Angeles
Arthur E. Smith, 511 Wilshire Med. Bldg., Los Angeles
F. A. Bricker, 1006 Pellissier Bldg., Los Angeles

COLORADO

Delegates

E. J. Zimmer, 719 Exchange Natl. Bank Bldg., Colorado Springs
W. O. Weber, Greeley
Bertram H. Downs, 609 Exchange Natl. Bank Bldg., Colorado Springs

CONNECTICUT

Delegates

J. Francis Keeley, 1115 Main St., Bridgeport
C. W. Vivian, 55 W. Main St., New Britain
J. Otis Miner, 48 Main St., New London
S. E. Armstrong, 129 Whitney Ave., New Haven

Alternates

William B. Brewster, 111 W. Main St., Bridgeport
J. D. Hertz, 46 Bedford St., Stamford
J. A. Bray, 99 Pratt St., Hartford
C. E. Peterson, 34 Park Place, Rockville

DELAWARE

Delegate

R. E. Price, Medical Arts Bldg., Wilmington

Alternate

P. A. Traynor, 807 Washington St., Wilmington

DISTRICT OF COLUMBIA

Delegates

C. W. Camalier, 1726 Eye St., N. W., Washington, D. C.
Mark F. Finley, 1928 Eye St., N. W., Washington, D. C.
A. D. Weakley, 1029 Vermont Ave., N. W., Washington, D. C.

Alternates

Chester A. Baker, 1726 Eye St., N. W. Washington, D. C.
E. W. Schultze, 1029 Vermont Ave., N. W., Washington, D. C.
H. A. Swanson, 1028 Conn. Ave., N. W., Washington, D. C.

GEORGIA

Delegates

R. Holmes Mason, Macon
J. R. Mitchell, Candler Bldg., Atlanta
Harry T. Bledsoe, Candler Bldg., Atlanta

Alternates

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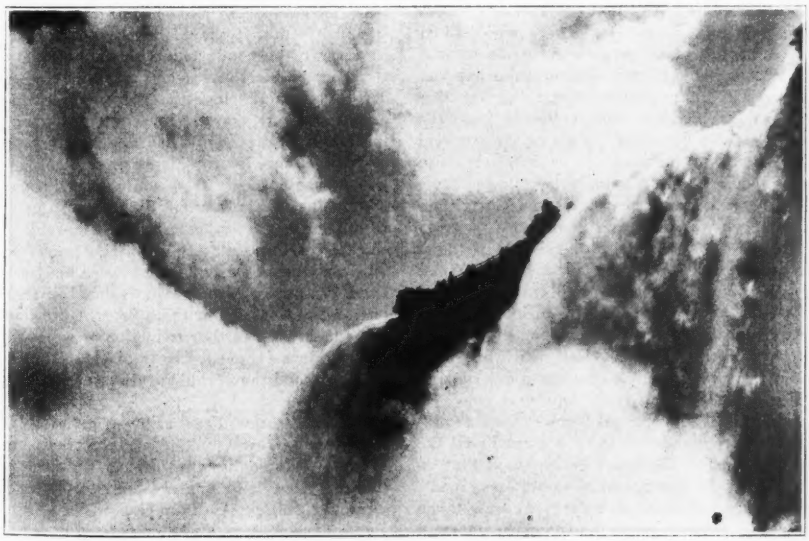

The American Falls, Niagara

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Radium Poisoning: The serious hazard in luminous dial painting has been recognized only since 1924, according to James P. Leake (*J.A.M.A.*, March 26, 1932), though fatal cases of poisoning by radioactive material in that occupation had occurred during the two preceding years. The poisoning has shown itself by bone disease, especially necrosis of the jaw, and by anemia. The condition is insidious and has a prolonged yet striking course. Many of the hazards have been removed by the use of mechanical devices, but an investigation was undertaken in December, 1928, to determine whether there were any remaining hazards and, if any, what means could be found for their prevention. The test covered all the dial painting factories in the United States with the exception of the few employing only from one to three workers. The test group consisted of workers exposed only since 1926. Those who had at least part of their experience prior to that year constituted the positive control group and those without radium exposure the negative control group. The dust collected from the air near the breathing points of the workers was found in some cases to be definitely more radioactive than dust similarly collected from the general air in the workrooms, though the difference was not great from those painting by hand. For some of those using mechanical processes and for some of those at other tasks, the amounts were considerably more. Settled dust on areas above the floor level and in cracks of the floor was also found to be somewhat radioactive, but a cloth which had been used for wiping paint brushes, glass stirring rods, crucibles and table tops was found to contain over ten times as much radium as that judged from samples to be present in all the settled dust in the room, exclusive of that on the floor. In the dental examinations, roentgenograms of the alveolar regions were taken because these regions had most frequently shown bone changes in cases of definite radium poisoning in dial painters, and because these regions offered the best place for roentgenography of bones with a minimum interposition of soft parts. Furthermore, there is a wider basis for comparison with normal variation than in almost any other part of the body, on account of the frequency with which dental roentgenograms are made. In the positive control group of workers with exposure before 1926, these films disclosed two conditions that appeared to be of importance in the study: focal atrophy and focal sclerosis. These bone changes were slight compared to the severe lesions which have been described in marked cases of radium poisoning. These changes were correlated with the gamma radiation from the bodies of the workers. The determinations of radioactivity in the dust of the working places show that there is present enough active material to account, in part at least, for radioactivity of some of the workers. It appears that it should be possible for the industry to be conducted with entire safety. Of the possible sources of ingress of radioactive material (ingestion, skin absorption and inhalation), massive ingestion by pointing the brush in the mouth has apparently been stopped. There is no evidence of skin absorption or radioactivity from sources outside the body. The inhalation of radioactive material as dust or as gaseous emanation is more difficult to control and deserves especial emphasis. The amounts of radium found in the body are small compared to the amounts noted in serious or fatal cases, but there is evidence that there must be a further reduction of exposure to provide a sufficient factor of safety under varying conditions and varying susceptibilities.

Electrothermic Treatment of Accessible Malignant Growths: The modern treatment of accessible malignant disease by electrothermic methods has passed the experimental stage, according to William H. Schmidt (*Arch. Phys. Ther. X-Ray, Rad.*, April, 1932), and is now established on a firm basis. The results obtained in a large series of cases have been

so satisfactory both from cosmetic and from curative points of view that there can no longer be any doubt of its superiority over other methods in use at the present time. Its value in a definite field of therapeutics is becoming more evident as technic is improved and experience increases. Electrosurgery in accessible malignant growths is the method par excellence for all precancerous lesions. It is an accurate and successful form of treatment for all cancer of the basal-cell type. Most cases of prickle-cell carcinoma are amenable to this treatment. There is no limit to the size or extent of the growth that can be treated, but good judgment in the treatment of the glandular metastasis spells success or failure.

Agranulocytosis in a Child: Report of a case of agranulocytosis in a child, aged 3½, with necropsy observations, is made by Empey and Proescher (*Am. J. Dis. Child.*, April, 1932), who conclude that their findings support the view that this disease is caused by an unorganized noxious agent that acts on the bone marrow, because no evidence of focal infection could be demonstrated clinically previous to the time when the granulocyte count fell so low as seriously to impair the body's defense against saprophytic organisms, and because a blood culture was negative during an afebrile remission of the disease, even though the granulocyte count was gradually falling. The only noxious agent that the authors were able to find in the case was exposure to the fumes given off by the flue of a gas-burning furnace in the home for a period of about three weeks, which occurred more than twelve months prior to the appearance of the first symptoms attributable to the disease. It is suggested that a careful history in forthcoming cases, including thorough questioning regarding the possibility of exposure to some chemical poison, might throw more light on the etiology. Blood transfusion and oral hygiene were the only therapeutic measures that seemed to be of value. The authors state: "Schultz and Leon called attention to the fact that in most cases severe dental disease had existed for some time before the agranulocytosis manifested itself, or that it followed dental treatment. However, there is no proof that the granulocytopenia did not exist before the dental infection. Bock and Weide noticed this connection in a large number of cases of acute leukemia, and further observation will be necessary to establish the connection between chronic septic dental conditions and agranulocytosis. There is a possibility that in long-standing cases of septic oral conditions, the leukopoiesis may be damaged by bacterial toxins. In view of the great prevalence of oral sepsis, the incidence of agranulocytosis is relatively small. Therefore, other unknown factors or certain constitutional conditions must be considered. Septic processes of the tonsils play no rôle. The necrosis is merely a manifestation of the disease." In summarizing, they state that all cases so far reported in children, with the general symptomatology and blood picture described, have proved fatal in less than six months after the onset of the first symptoms, and that because symptomatic cases such as are occasionally found after a prolonged pyogenic infection or other chronic diseases have a better prognosis in children, these cases should be distinguished whenever possible from the type of case reported here. For the present, it is added, the latter may be called idiopathic or primary agranulocytosis and the former can be considered as secondary.

Plastic Surgery and the Specialists: Cleft Lip and Cleft Palate: Notwithstanding the progress made in this surgery during the last decade, we still too often see end-results in cleft lip and cleft palate operations which leave much to be desired from functional and esthetic points of view. The surgical technic at our disposal today for the repair of a cleft lip deformity is of such precision as to preclude the possibility of further failures in this surgery. In the more complicated types of double cleft lip and cleft palate, satisfactory end-results can be expected if this surgery is done in successive stages. The general principles of reconstructive surgery are to be applied here as in other large skin defects: the proper outlining of flaps provided with adequate blood supply, sufficient undermining of the surrounding skin and mucous membrane, avoidance of tension, and the use of fine suture material are the deciding factors which make for a successful end-result. The necessity for an early operation of cleft lip, four to five weeks after birth, and the closure of the palate at the age of from twelve to eighteen months is to be strongly impressed upon the mind of the obstetrician and pediatrician.

Early and competent speech training in young children is required to assure a good functional result without which even the most successfully closed palate is a partial failure.—J. W. Maliniak, in *Am. J. Surg.*, November, 1931.

MISCELLANY

BOOK REVIEW

Your Teeth and Their Care—A Simple Explanation of Dentistry, Dental Procedures and the Relation of the Dentist to the Public. By Carl W. Adams, D.D.S., San Bernardino, Calif. Illustrated; 141 pages; price, $1.25. Published by the C. V. Mosby Company, St. Louis.

The object of this book is to spread information as widely as possible on the teeth and their care. There is nothing new or spectacular in the book, but the author has endeavored to formulate some simple and sane observations that should be helpful. In one instance, it would seem desirable to modify somewhat a statement to the effect that "a pulp once infected in most instances means the loss of the tooth." This would seem to be a sweeping intimation that pulpless teeth should not be saved, and we are sure that the author does not mean quite that.

The book is a readable little volume, well worthy of a place in every library.

THE UNDERMINING OF NATIONAL CHARACTER BY SOCIAL INSURANCE

By EDWARD H. OCHSNER, M.D., Chicago, Ill.

Parasitism is today the corroding canker of modern civilization and anything which favors its growth and dissemination should be unequivocally condemned and most vigorously opposed.

The proponents of compulsory health insurance, or national insurance, as it is called in England, reiterate again and again that these and the dole are totally different. In name and administration, yes; in effect, no. They both encourage people to want something for nothing or much for little, which in effect makes parasites of them. Almost endless illustrations supporting the statement that compulsory health insurance and the dole are alike in effect could be produced, but one will have to suffice. Liek, in his book, recounts the following experience he had while a *Krankenkasse* physician in Germany. A middle-aged man came to him for an examination with the view of securing sick benefit. Liek examined the patient carefully, but could find nothing the matter with him; in fact, found him unusually well-developed and robust. From the man, he elicited the fact that he was the only man in his village that did not get some kind of a government stipend, sick benefit or dole or pension and that everybody was ridiculing him because of this.

No one who is at all familiar with the writings of Bernard W. Shaw will ever accuse him of being in favor of the present economic system in England. He has the following to say of the dole: "The Labor Party has just twisted conditions all around. They taxed people who live on unearned income, and create their own leisured class—people who live on the dole. The dole is not much but if you have four or five in one family living on dole you have a hostel of leisured people living very well. That must cease."

The whole social insurance scheme is based on the ethically indefensible theory that individuals are entitled to things that they have not earned and on the politically unsound doctrine that society owes every citizen a comfortable living whether or not he repays society by doing his fair share of the world's work. Under compulsory health insurance, the individual who works only half-time is entitled to just as much free medical service and is likely to get much more in sickness benefits than he who works full time. Not only this: the situation actually encourages immorality and riotous living as the following personal experience well illustrates. As a young man, I worked two seasons in a lumber camp. The camp in which I lived comprised between thirty-two and forty men. Of this number, only one did not use intoxicating liquor; only two did not use tobacco, and half of the men spent their hard-earned wages either at the saloons in the nearby town or went regularly to the Island or did both. Those who are

familiar with the islands of the upper Mississippi River need no explanation as to why they went there. I wonder how health insurance, insuring these men for loss of time and providing free medical care for them, would have prevented their doing the very things that were the cause of much of their sickness. For my part, I believe that a larger percentage of them would have gone to the Island if they had felt that they would be protected against loss of time and that they would receive free medical care if they became sick. Health insurance would actually have increased not only sickness but immorality as well in this camp.

In a recent survey at the University of Minnesota only ten, or two per thousand, of 5,000 students were found to give a positive reaction to the Wassermann test. Careful surveys in various parts of the country indicate that about 3 per cent, or thirty per thousand, of the general population of the United States is syphilitic. A Wassermann examination of 3,000 prisoners in the Southern Illinois Penitentiary revealed the fact that three in ten, or three hundred per thousand, were syphilitic. This same ratio undoubtedly pertains to the class most criminals come from and raises the average in the general population.

It is a well-known fact that alcoholics and those suffering from venereal disease are much more liable to loss of time from sickness than are those not so affected. What right has any government to take of the earnings of the two first groups without their consent and give them to the third group? A just and humane government protects the weak from oppression and exploitation by the strong and unscrupulous; but a just and wise government does not penalize the strong, industrious, clean-living and thrifty and favor the weak, lazy, shiftless and immoral. Giving the weak, lazy and shiftless undue advantage over the strong, industrious, and thrifty actually penalizes and handicaps the latter, interferes with the law "of the survival of the fittest" and must eventually lead to race degeneracy. If the white race persists in this course long enough, the "yellow peril," so often glibly and jokingly mentioned, may become a real menace to western civilization.

All independent writers on the subject state, and even the proponents of compulsory health insurance have to admit, that it has tremendously increased occupational neuroses, and that is just what was to be expected and was expected by those who know human nature and can see just a little farther than the end of their nose.

The following quotation from a paper by William H. Hicks is pertinent: "In accident cases, where the question of compensation is involved, conditioned reflexes are sometimes created by the patient's environment that not only retard recovery but instigate additional symptoms; or may lay the foundation for successful malingering."

One of the worst features of compulsory health insurance is that, if continued long enough, it will crush out of one's character the three i's—independence, industry and integrity. Such schemes are, as Guglielmo Ferrero, the Italian historian, rightly says, "artificial," and "While they tide over trifling evils of the moment, they lay up for the future troubles and difficulties and dangers of infinitely greater gravity."

(To be continued)

THE BREAKING OF HYPODERMIC NEEDLES

The breaking of hypodermic needles, leaving the broken fragment in the tissues of the patient, continues to furnish one of our great medical defense societies, the London and Counties Medical Protection Association, with a difficult problem. The physician or the dentist who administers the injection incurs a legal liability for negligence to the patient, who can allege want of skill. If the physician pleads that he used the needle correctly but that there was some flaw in its manufacture, he is liable for using such a needle, though for this the manufacturer has a liability to him. But the trouble is that it is impossible to say why certain needles break and whether this is due to any flaw in their manufacture. It has been suggested that they may be injured by antiseptic solutions. The London and Counties Medical Protection Society thoroughly investigated the subject and consulted expert metallurgists. They issued in their annual report a number of recommendations: 1. A new needle should be used in every case. 2. Needles should never be "flamed" as this may injure the temper. 3. As the needle always breaks at the point of entry into the holder, a short holder should be used, so that if fracture occurs, a large portion will remain in the tissues, and thus be more easily removed. 4. Needles should not be kept in watery solutions. 5. Better results are obtained

from needles made of alloy steels (such as stainless steel), which do not require subsequent heat treatment and are generally more flexible than those made of carbon steel. But, though these recommendations were issued two years ago, the breakages continue to occur. The secretary of the society attributes some of the accidents to the use of too fine needles. Though roentgenography has been employed, it has generally proved impossible to remove the fragment by operation. So far, no case has been taken into court, but in some cases, damages have been paid to settle the matter.—London letter, *J.A.M.A.*

CORRESPONDENCE

Histologic Investigations on Edentulous Jaws

To the Editor:

I read with great interest the paper of E. C. Pendleton in the April, 1932, issue of The Journal. The author makes the statement that no histologic investigation has been undertaken on edentulous jaws up to this time. May I call attention to a paper published in the May, 1931, issue of the *Zeitschrift für Stomatologie,* page 673, in which I gave a description of the hard and soft tissues of the upper and lower edentulous jaws and discussed the taking of impressions for full dentures as based on the findings in histologic investigation. Pendleton repeated these investigations, with similar results.

Richard Grohs, M. D.,
Vienna IX,
Frankgasse 1,
Austria.

P. S.: A reprint of the paper mentioned above is enclosed for your package library.

NEWS

Dr. Cogan Given Degree: At the exercises conducted at Mt. St. Mary's College, Emittsburg, Md., June 8, the degree of LL.D. was conferred on Lieut. Comdr. William Neal Cogan (D.C.), U.S. Navy, retired. Dr. Cogan was largely instrumental in the establishment and organization of the dental corps of the Navy and was one of the first group of officers to be commissioned in that corps. On retirement from active duty, Dr. Cogan was appointed dean of the school of dentistry, Georgetown University, and has served in that capacity since that time.

Dr. Mack Honored: Commander Cornelius H. Mack, Dental Corps, U.S. Navy, was one of the two recipients of the honorary degree of LL.D. at the eighty-third commencement of Holy Cross College, Worcester, Mass., June 15th. Dr. Mack is on duty as chief of dental service at the U.S. Naval Hospital, Brooklyn, N.Y.

Death of Dr. Williams: Raymond Lester Williams, who received his dental degree in the class of 1896, University of Michigan, College of Dentistry, died October 26, 1931; aged 59. Dr. Williams moved from Appleton, Wis., to Milwaukee in 1914, where he practiced until his death. He was accredited representative to the Fifth International Dental Congress in Berlin in 1909 and during the World War was stationed in New York, where he treated disabled veterans.

New School of Dentistry at the University of Detroit: An announcement has recently been made that the present two years of predental instruction at the University of Detroit, which has been given on the campus for some time, will be augmented by the remaining three years of dental study. Thus there will be a full course in dentistry given at the university. The class which is now being enrolled, beginning in September will be conducted on the new university campus at Six Mile Road and Livernois Avenue. In 1933 and 1934, the junior and senior classes will receive their instruction in Dinan Hall, in downtown Detroit, in which the clinic will be installed.

"The Dental Assistant": This is the name of a monthly magazine published in the interests of the dental assistant wherever she may be located, and containing news items and informative material touching on the problems of the assistant and on her welfare generally. It is published by the Educational and Efficiency Society for Dental Assistants, First District, New York. The editor is Juliette A. Southard, 174 West 96th Street, New York City.

Medal of Purple Heart Presented to Dr. Meyer: Almost thirty-one years after the episode, George E. Meyer, Chicago, has been awarded the Medal of the Purple Heart by the War Department, for his part in the Balangiga Massacre in the Philippines. The presentation was made by Maj. Gen. Frank Parker, before the troops at the George Washington Bicentennial Military Tournament. The Purple Heart was originated during George Washington's time, having recently been revived. The Balangiga Massacre took place at Samar, P. I., Sept. 29, 1901,

when a band of natives, lead by the police chief, surprised an American garrison, killing forty-eight and wounding twenty-three before they were dispersed. Dr. Meyer was bugler of the guard. He was slashed and beaten as he grappled with a native, and was saved only when a fellow soldier killed his assailant.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Buffalo, N.Y., September 12-16.

American Academy of Restorative Dentistry, Buffalo, N. Y., September 11-12.

American Academy of Periodontology, Buffalo, N. Y., September 8-10.

American Congress of Physical Therapy, New York City, September 6-9.

American Full Denture Society, Buffalo, N. Y., September 9-10.

American Society for the Advancement of General Anesthesia in Dentistry, New York City, October 24.

American Society for the Promotion of Children's Dentistry, Buffalo, N. Y., September 15.

American Society of Oral Surgeons and Exodontists, Buffalo, N. Y., September 9-10.

. Association of American Women Dentists, Buffalo, N. Y., September 12.

British, Canadian and Ontario Dental Associations, Toronto, August 8-12.

Congress of International Anesthesia Research Society, New York City, October 17-21.

Fédération Dentaire Internationale, Zurich, Switzerland, August 2-9.

Greater New York December Meeting, New York City, December 5-9.

Italian Stomatologie Congress, Rome, September.

Montreal Dental Club, October 13-15.

National Association of Dental Examiners, Buffalo, N. Y., September 10.

Odontological Society of Western Pennsylvania, Pittsburgh, November 8-10.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

Southern Society of Orthodontists, Knoxville, Tenn., October 31-November 2.

American Dental Assistants Association, Buffalo, N. Y., September 12-15.

American Dental Hygienists' Association, Buffalo, N. Y., September 12-16.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

November

Florida, at Hollywood (3-5).

December

Ohio, at Cleveland (5-7).

ODONTOLOGICAL SOCIETY OF WESTERN PENNSYLVANIA

The fifty-first annual meeting of the Odontological Society of Western Pennsylvania will be held in Pittsburgh at the William Penn Hotel, November 8-10. This is to be the eightieth anniversary of the organization of dentistry in Western Pennsylvania.

W. EARLE CRAIG, *Secretary*,
Jenkins Arcade,
Pittsburgh.

SPECIAL BONE DEMONSTRATION AT JOHNS HOPKINS UNIVERSITY

Monday, September 19, has been set aside out of the annual bone demonstration week at Johns Hopkins University School of Medicine, Baltimore, for a special demonstration to oral surgeons and dentists interested in the pathology of the oral cavity and lesions of the teeth. The demonstration, which will be given in three sessions, morning, afternoon and evening, will consist of a showing of lantern slides of roentgenograms, presented with a history of the case, which those present will be asked to diagnose in writing, a general discussion to follow. An abundance of material of interest to dentists is available, and it is the intention to carry out the above-outlined plan if as many as twenty dentists signify their intention to attend. Tuesday, September 20, is

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

reserved for those attending the demonstration who have a special case on which they desire help. Those interested in this special bone demonstration should communicate with T. A. Hardgrove, Commercial Nat'l Bank Bldg., Fond du Lac, Wis.

AMERICAN CONGRESS OF PHYSICAL THERAPY

The eleventh annual scientific session of the American Congress of Physical Therapy will be held September 6-9, at the Hotel New Yorker, New York City.

NORTHWESTERN DENTAL SCHOOL ALUMNI LUNCHEON

The Northwestern Dental School Alumni will meet at luncheon in the Chinese Room, Hotel Statler, September 13, at 12 m. Tickets, $1.

BURTON A. HOFFMAN, *Chairman,*
Arrangement Committee

ELEVENTH ANNUAL CONGRESS OF ANESTHETISTS

The eleventh annual congress of the International Anesthesia Research Society will be held at the Hotel McAlpin, New York City, October 17-21. An invitation is extended to all ethical members of the dental profession.

HARRY M. SELDIN,
Chairman of Dental Clinics,
57 W. 57th St.,
New York City.

New York Central Terminal, Buffalo

PACKAGE LIBRARIES*†

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†Abnormal secretion of saliva.
Absorption of roots and bone.
†Agranulocytic angina.
Alveolar process—its structure, anatomy and resorption.
Alveolectomy.
†Amalgam dyes.
Amalgam fillings and physical properties of amalgam.
Anesthesia—discovery and early uses.
†Anesthetics in children's dentistry.
Angle's orthodontic appliances.
Apicoectomy.
Articulation, occlusion and mandibular movements.
Bacteria of the mouth.
Bacteriological studies of root canals.
Best time for orthodontic treatment.
Biographies of dentists.
Blood count in focal infection.
Bogue's articles from Dental Digest.
†Bridges using inlays as abutments.
Broken needles.
Bureau of Standards reports.
Business side of dentistry.
Calcium metabolism.
Cancer of mouth.
Carbon dioxide administered in conjunction with nitrous oxid-oxygen anesthesia.
†Cast gold crowns.
Cast gold inlays.
Casting gold, including inlays and dentures.
Cavity preparation.
†Cementation of inlays.
†Child psychology.
Children's dentistry.
Clasps—wire and cast.

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*Each package library contains information on one of the subjects listed and is composed of reprints, magazine clippings, etc., on that subject only. The packages are loaned to members of the Association for a period of one week after date of receipt. Unless the material is reserved for another borrower, an extension of time will be granted on request.

The rental fee for borrowing a package library is 50 cents. This fee must accompany the request for a package library. No packages are sold. In response to requests, packages will be compiled on other subjects pertaining to dentistry.

†These packages contain less than the usual number of articles.

Cleft lip and palate—etiology and surgical treatment.
†Cleft palate—orthodontic treatment and prosthetic appliances.
Community and school dental service.
Comparative dental anatomy.
Conduction anesthesia.
Condyle path movements.
†Congenitally missing teeth.
Contributions dentists have made outside their profession.
†Curetting.
Cysts and tumors of mouth.
Dental assistants.
Dental care of the preschool child.
Dental caries.
Dental cements.
Dental clinics.
†Dental disease and practice in the tropics.
Dental economics.
Dental education.
Dental education in the U. S.—history.
†Dental erosion.
Dental ethics.
Dental health education.
Dental hygienists.
Dental libraries.
Dental metallurgy.
†Dental nomenclature.
Dental service in the World War.
Dental technicians.
Dentifrices.
Dentistry as a career and the status of the dentist.
†Dentistry in foreign lands.
Denture bases—discussion of materials.
Denture casting.
Diathermy in dentistry.
Diet and nutrition in relation to teeth.
Diet in pregnancy.
Dry socket.
Education of denture patients.
†Emphysema.
Enamel—decalcification and recalcification of.
Endocrine glands in relation to teeth.
Epithelial débris.
†Eruption of teeth—dates of eruption and accompanying symptoms.
†Eruption of teeth—theories regarding.
Esthetics in denture construction.
Ethyl chlorid.
Ethylene anesthesia.
Etiology of caries.
Etiology of malocclusion and preventive orthodontia.
Etiology of pyorrhea and its relation to systemic conditions.
Evolution of human dentition.
Examination of the mouth and oral diagnosis.
Extraction of teeth.
†Facebow technic and recording of occlusion.
Fauchard's (Pierre) life.
Fixed and removable bridgework.

Fixed bridgework.
Focal infection.
†Focal infection and arthritis.
†Focal infection and oral sepsis in relation to gastro-intestinal disturbances.
Focal infection in relation to diseases of the eye.
Foreign bodies (of dental origin) in the lungs and esophagus.
Fractures of the jaws.
†Frenum labium.
Full denture construction.
†Gagging.
Gillett and Irving's articles on indirect inlay technic.
Gold foil.
Growth and development of teeth and jaws.
Habits as factors in malocclusion.
Hemophilia or excessive hemorrhage following extraction.
Hereditary influences in malocclusion.
†Histologic examinations of fractured roots.
Histologic study of teeth and tissues.
Histology of peridental membrane.
History and progress of dentistry.
History of dentistry.
†History of full denture construction.
Hospital dental service.
†Howe's (Percy) articles on diet.
†Hypercementosis and excementosis.
†Hypnotism.
Immediate denture service.
Impacted teeth and their removal.
Impacted third molars.
Implantation, replantation, transplantation of teeth.
Impression materials and technic.
†Impression taking for cast gold inlays.
Impression technic.
Indirect inlay technic.
Industrial dental service.
Influence of deciduous teeth and first permanent molars on occlusion.
Influence of diet on saliva.
Interpretation of roentgenograms.
Investment compounds and technic.
Ionic medication.
†Jackson's (V. H.) articles on orthodontic appliances.
Lectures to nurses.
Lesions of the mouth.
Local anesthesia.
Local anesthesia—contraindications and untoward results.
Lower denture construction.
†Ludwig's angina.
Malpractice in dentistry.
Materia medica and pharmacology.
†Matrix.
Maxillary sinus and antrum—diseases and treatment.
Methods of sectioning and staining teeth.
Monson's theory.
Mottled enamel.
Mouth hygiene.
Muscle exercises and training in orthodontia.

Nitrous oxid-oxygen analgesia.
Nitrous oxid-oxygen anesthesia.
†Occlusion in relation to operative dentistry.
†Opening the bite.
Oral diagnosis with reference to roentgen ray.
Oral manifestations of systemic conditions.
Organized dentistry.
Orthodontia and its relation to dentistry and medicine.
†Orthodontic anchor bands.
Orthodontic appliances.
Orthodontic diagnosis and measurements.
†Orthodontic treatment of impacted cuspids.
Osteomyelitis of the jaws.
"Panel" or insurance dentistry.
Partial dentures.
†Permeability of tooth structures.
Physical therapy in dentistry.
†Pinledge and pinlay attachments.
Place of extraction in orthodontic treatment.
Plastic surgery.
Pollia's articles on radiology.
Porcelain in dentistry.
Porcelain inlays.
Porcelain jacket crowns.
Postoperative complications and care.
†Postoperative psychosis.
Pregnancy and dental disease.
Preoperative examination of patients.
Preparation of cavities with hypersensitive dentin.
Preventive dentistry.
Procain (novocain) dermatitis.
†Program building for state and district societies.
Prophylactic odontotomy.
†Pulp amputation.
Pulp conservation including pulp capping and cavity lining
†Pulp pathology.
†Pulp stones.
Pyorrhea.
Relation between dental conditions and mental health of insane.
Relation of the dentist to the physician.
Removable bridgework.
†Removable bridgework—discussing various types of attachments.
Research Commission reports.
Restoration of oral functions including opening the bite.
Retainers used in orthodontia.
Retention of deciduous teeth and delayed eruption of permanent teeth.
†Retrusion of the mandible causing impaired hearing.
Root canal treatment.
†Salivary calculus.
†Salivary glands.
†Shock, syncope and collapse.
Should dentistry be advertised?
Silicate cements (see dental cements).
†Silver nitrate.
†Smith's articles on oral prophylaxis.

†Space retention—its importance and methods of accomplishing.
†Status lymphaticus.
Sterilization of dental instruments.
Stomatology.
Stories and rhymes for children.
Studies of saliva.
Suggestions for talks to mothers.
Suggestions for talks to students.
†Supernumerary teeth.
Surgical treatment of pyorrhea.
Three-quarter crowns.
Tooth arrangement for full dentures.
Toothbrushes and toothbrushing technic.
Toothbrushes, tooth pastes and mouth washes.
†Torus palatinus.
Traumatic occlusion.
Trigeminal neuralgia.
Trismus and ankylosis.
Tuberculosis and dentistry.
Ultraviolet ray in the treatment of pyorrhea.
Ultraviolet ray therapy in dentistry.
Undergraduate and graduate orthodontic education.
Use of elevators in extraction.
Value of dental service in schools.
Value of roentgen-ray examinations in orthodontia.
Various studies of or pertaining to saliva.
Vincent's infection.
Vulcanite and vulcanite stomatitis.
Wax expansion method.
†Waxes.
†Willett's articles.

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